SEDIMENTOLOGY, ICHNOLOGY, AND STRATIGRAPHIC ARCHITECTURE OF THE UPPER DEVONIAN-LOWER MISSISSIPPIAN BAKKEN FORMATION, WEST-CENTRAL SASKATCHEWAN

A Thesis Submitted to the College of

Graduate Studies and Research

In Partial Fulfillment of the Requirements

For the Degree of Master of Science

In the Department of Geological Sciences

University of Saskatchewan

Saskatoon

By

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June, 2015

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ABSTRACT

The Upper Devonian-Lower Mississippian Bakken Formation has recently become a prolific producer of light gravity oil in southeastern Saskatchewan since the advent of horizontal drilling and multi-stage hydraulic fracture technologies, which has resulted in an increase in geological studies within the area. However, the Bakken Formation of west-central Saskatchewan has been producing heavy oil since the 1950s, and has comparatively received much less attention than its southeastern counterpart.

The Bakken Formation is the youngest member of the Three Forks Group and unconformably overlies the Big Valley Formation. In west-central Saskatchewan, the Bakken Formation can be conformably overlain by the Mississippian carbonates of the Madison Group or unconformably overlain by the Lower Cretaceous Mannville Group.

A tripartite subdivision is applied to the Bakken Formation, with a mixed clastic/carbonate Middle Member deposited between Lower and Upper Black Shale Members. Based on detailed core description, eight facies have been defined for the Bakken Formation of west-central Saskatchewan: Facies 1 (Lower and Upper Black Shale members), Facies 2 (bioturbated siltstone/sandstone), Facies 3 (wave-rippled sandstone), Facies 4 (bioclastic grainstone), Facies 5 (interbedded mudstone, siltstone, and very fine-grained sandstone), Facies 6 (very fine- to fine-grained sandstone), Facies 7 (bioturbated siltstone/sandstone), and Facies 8 (massive and brecciated siltstone).

Deposition of the Bakken Formation in west-central Saskatchewan occurred under either open-marine or marginal-marine conditions. Facies association 1 (open-marine interval), which is made up of F1 through F4, is characterized by the distal *Cruziana* Ichnofacies. It was deposited within a wave-dominated shallow-marine depositional environment. Facies association

2 (marginal-marine interval), which is comprised of F5 through F8, shows scarce biogenic structures, most likely as a result of brackish-water conditions.

Geological mapping (structure surface and isopach) of the facies and facies associations has aided in illustrating their lateral distribution. However, mapping of the overlying Mississippian carbonates and sub-Mesozoic unconformity shows that post-Mississippian erosion was a controlling factor in the distribution and preservation of Bakken Formation deposits, which creates uncertainty when interpreting geological maps and stratigraphic cross-sections. Although post-Mississippian erosion causes problems when reconstructing the depositional history and stratigraphic architecture of the Bakken Formation, it illustrates the importance of not performing stratigraphic studies within a vacuum, only focusing on the formation of interest. Rather, underlying and overlying units must be studied to see whether or not the unit of interest's deposition and distribution has been affected by pre- and post-depositional events.

ACKNOWLEDGMENTS

I am very grateful for the support and advice of my supervisor, Dr. Luis Buatois. Without his knowledge, guidance, feedback, and encouragement, this project would not have been possible. Furthermore, the freedom he gave me to find my way throughout the course of this project has taught me to think critically, logically, and creatively.

Thank you to all the staff at the Subsurface Geological Laboratory in Regina, Saskatchewan, in particular Dan Kohlruss for his help surrounding the many technical aspects of this study, but more so for the numerous discussions with regards to the sedimentology and stratigraphy as it pertains to this study. Arden Marsh at the Ministry of Energy and Resources was a constant help in the preparation of geological maps. His technical expertise with mapping software was an invaluable resource in the completion of this project.

To Dr. Luis Buatois and Dr. Gabriela Mángano, thank you for creating an environment within which the discussion and promotion of ideas is not only encouraged, but expected. You have created a research group that is not only intellectually stimulating but a blast to be a part of.

This project would not have been possible without the financial support received from the Petroleum Technology Research Centre (PTRC) in Regina, Saskatchewan through a research grant awarded to Dr. Chris Hawkes.

DEDICATION

To my family and friends. For everything.

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CHAPTER 1

1. INTRODUCTION

The Devonian-Mississipian Bakken Formation is currently one of the foremost tight oil plays in North America, with southeastern Saskatchewan and North Dakota seeing large rises in exploration and production since the advent of horizontal drilling and multistage hydraulic fracturing systems near the turn of the century. Although the Bakken Formation is currently well known for its proficiency in producing light gravity oil in southeastern Saskatchewan and North Dakota, it has produced heavy oil (~12° API) in west-central Saskatchewan using conventional methods since the 1950s.

The Bakken Formation is a tripartite mixed clastic-carbonate unit subdivided into three Members: Lower and Upper Black Shale Members that bound a heterolithic Middle Member composed of sandstone, siltstone, mudstone, and carbonate (Christopher, 1961). The Bakken Formation subcrops throughout the Williston Basin in southern Saskatchewan, northeastern Montana, northwestern North Dakota, and southwestern Manitoba, with age equivalents in Alberta and Montana in the Exshaw Formation and Sappington Member of the Three Forks Formation, respectively (Figure 1.1). However, the complete tripartite succession is incomplete in Manitoba, where the middle member directly overlies the Torquay Formation (Christopher, 1961; Kreis et al., 2006) as well as in west-central Saskatchewan, where erosion has, at times, completely removed the Bakken Formation (Christopher, 1961; Christopher, 2003).

Figure 1.1 - Distribution of the Bakken Formation and its age equivalents within the Williston Basin (taken from Smith and Bustin, 2000)

Regionally, the Bakken Formation is underlain by the Devonian carbonates of the Big Valley and Torquay formations. The Mississippian Madison Group carbonates overlie the Bakken Formation, however in west-central Saskatchewan the Madison Group has, in large part, been removed through sub-Cretaceous erosion, in which case the Bakken Formation is uncomformably overlain by the Jura-Cretaceous Success Formation or, more commonly, Lower Cretaceous Mannville Formation deposits (Christopher, 1961; Christopher, 2003) (Figure 1.2).

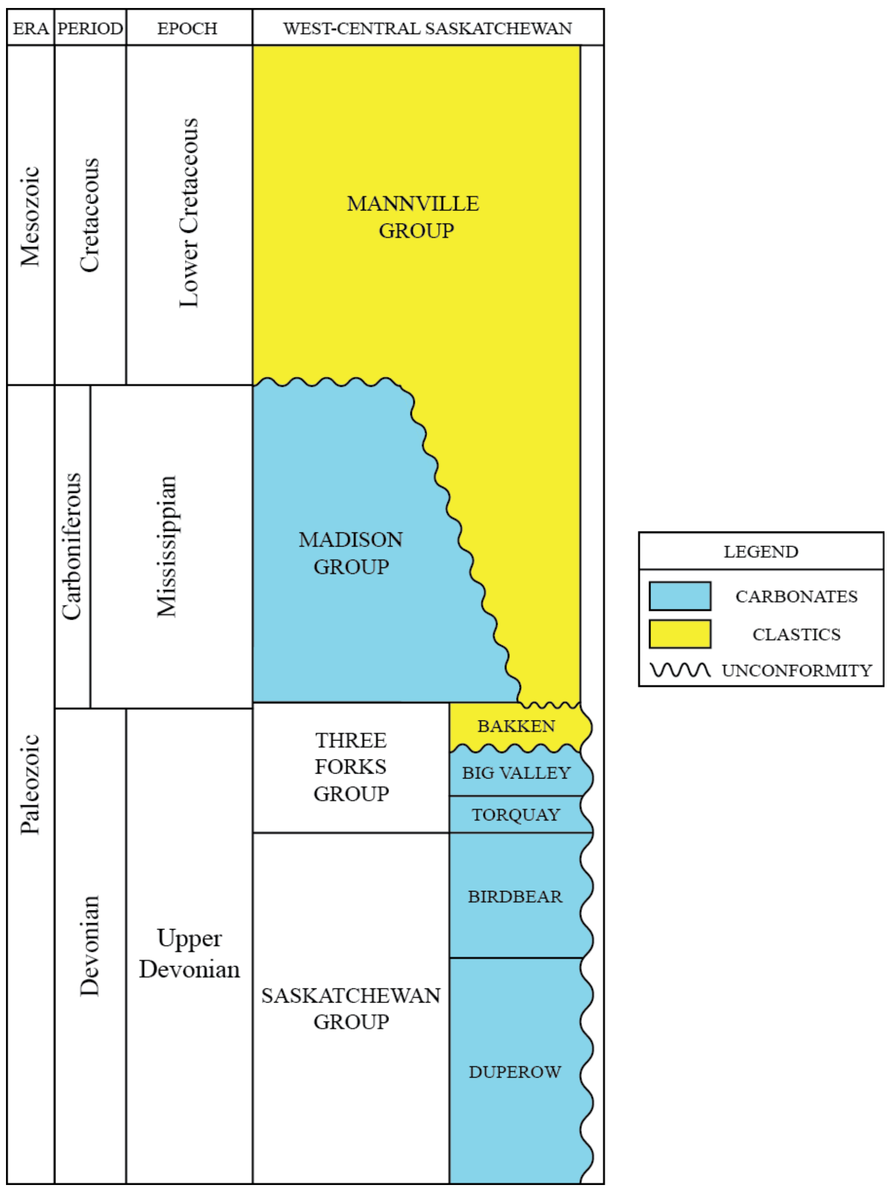

Figure 1.2 - Stratigraphic column of the Bakken Formation, west-central Saskatchewan

Recent studies have focused on the Bakken Formation in southeastern Saskatchewan (Kreis et al., 2005; Kreis et al., 2006; Angulo et al., 2008; Angulo and Buatois, 2009; 2010; 2011; 2012a; 2012b; Kohlruss and Nickel, 2009; Luo and Coulson, 2014) where the advent of horizontal drilling technology and multistage hydraulic fracturing systems has led to an increase in producing wells. The number of studies documenting the Bakken Formation of west-central Saskatchewan is much smaller as well as less current, with the majority of the work having been included as part of regional scale studies, (Christopher, 1961; Smith et al., 1995; Caplan and Bustin, 1996; Smith and Bustin, 1996; Smith and Bustin, 1997; Caplan and Bustin, 1998; Smith and Bustin, 1998; Smith and Bustin, 2000) than those in southeastern Saskatchewan. Although the vast majority of studies that include the Bakken Formation of west-central Saskatchewan are regional there has been a small number of studies focusing solely on west-central Bakken (Ducharme and Murray, 1980; Kasper, 1995; Toews, 2005).

This thesis will help answer some of the questions that still remain when it comes to the stratigraphic architecture of the Bakken Formation of west-central Saskatchewan through the documentation and interpretation of the sedimentary facies, trace fossils, depositional environments and sequence stratigraphy in the study area (Ranges 20W3 to 29W3, Townships 30 to 36).

1.1 Purpose and Objectives

The objectives of this study are to provide a detailed sedimentologic, ichnologic, and sequence-stratigraphic interpretation of the Bakken Formation of west-central Saskatchewan. Although previous studies have referred to the trace-fossil content of the west-central Bakken Formation, the importance of ichnology in delineating changes in environmental conditions during sedimentary deposition has increased in importance during the last 5-10 years, with energy companies coming to the realization that the identification of ichnofacies as well as discrete ichnotaxa can aid in laterally delineating hydrocarbon reservoirs. Therefore, a reinterpretation of the study area where ichnology, alongside sedimentological data, plays a central role rather than an auxiliary role in interpreting the facies distribution of the Middle Member is warranted.

Furthermore, the complex depositional history that followed deposition of west-central Bakken Formation has never fully been taken into account when reconstructing the depositional history and stratigraphic architecture of the area. Unraveling how post-Mississippian erosion may have affected the distribution of Bakken sediments is an important factor to consider when it comes to the interpretation of the Bakken Formation, most notably when reconstructing its stratigraphic architecture.

This thesis has practical implications as it pertains to the exploitation of the oil pools within the study area. Although the area is mature with regards to hydrocarbon production, having a better understanding of the lateral distribution of potential hydrocarbon bearing zones through an in depth knowledge of the producing horizons and how they can be identified on well-logs can allow for a higher degree of precision when selecting potential production targets.

1.2 Previous Work

The majority of the studies carried out on the Bakken Formation have either been on a regional scale (Fuller, 1956; Christopher, 1961; Smith et al., 1995; Caplan and Bustin, 1996; Smith and Bustin, 1996; Smith and Bustin, 2000) or in the southeastern part of the province (Lefever et al, 1991; Kreis et al., 2005; Kreis et al., 2006; Halabura et al., 2007; Angulo et al., 2008; Angulo and Buatois, 2009; 2010; 2011; 2012a; 2012b; Kohlruss and Nickel, 2009; Nickel, 2010; Luo and Coulson, 2014; Zhang, 2015). By comparison, fewer have focused solely on the Bakken Formation of west-central Saskatchewan (Fuller 1956; Kasper, 1995; Mageau et al., 2001; Toews, 2005).

Christopher (1961) proposed a tripartite subdivision of the Bakken into three members: Lower and Upper Members consisting of black shales with a heterolithic carbonate/clastic Middle Member that is still applied today. Originally, the Upper and Lower Members were interpreted as having been deposited in swamp environments along the shoreline of a shallow-water sea (Christopher, 1961). However, later studies interpreted these black shales as having been deposited under open-marine conditions where overall energy conditions were low and anoxic conditions prevailed (Karma, 1991; Lefever et al., 1991; Caplan and Bustin, 1996; Smith and Bustin, 1996).

Early studies interpreted the Middle Member as having been deposited in a transgressive shallow-marine environment where a marine transgression allowed for deposition of allochtonous sediments within the basin (Fuller, 1956; Christopher, 1961). Christopher (1961) originally subdivided the Middle Member into two main units, Unit A being described as a calcareous siltstone and Unit B being described as a heterolithic unit containing a combination of mudstone, siltstone and very fine- to fine-grained sandstone.

More recent studies of the Bakken Formation have continued to subdivide the Middle Member of the Bakken Formation (Lefever et al., 1991; Kasper, 1995; Smith and Bustin, 1996; Toews, 2005; Angulo and Buatois, 2012) (Figure 1.3). These studies have resulted in a wide range of depositional reconstructions including progradational shoreface sequences (Smith and Bustin, 1996; Angulo and Buatois, 2012) during a marine regression, brackish marine embayment deposition within an overall transgressive system (Kasper 1995; Angulo and Buatois, 2012), and tidally influenced sandstone ridges (Toews, 2005).

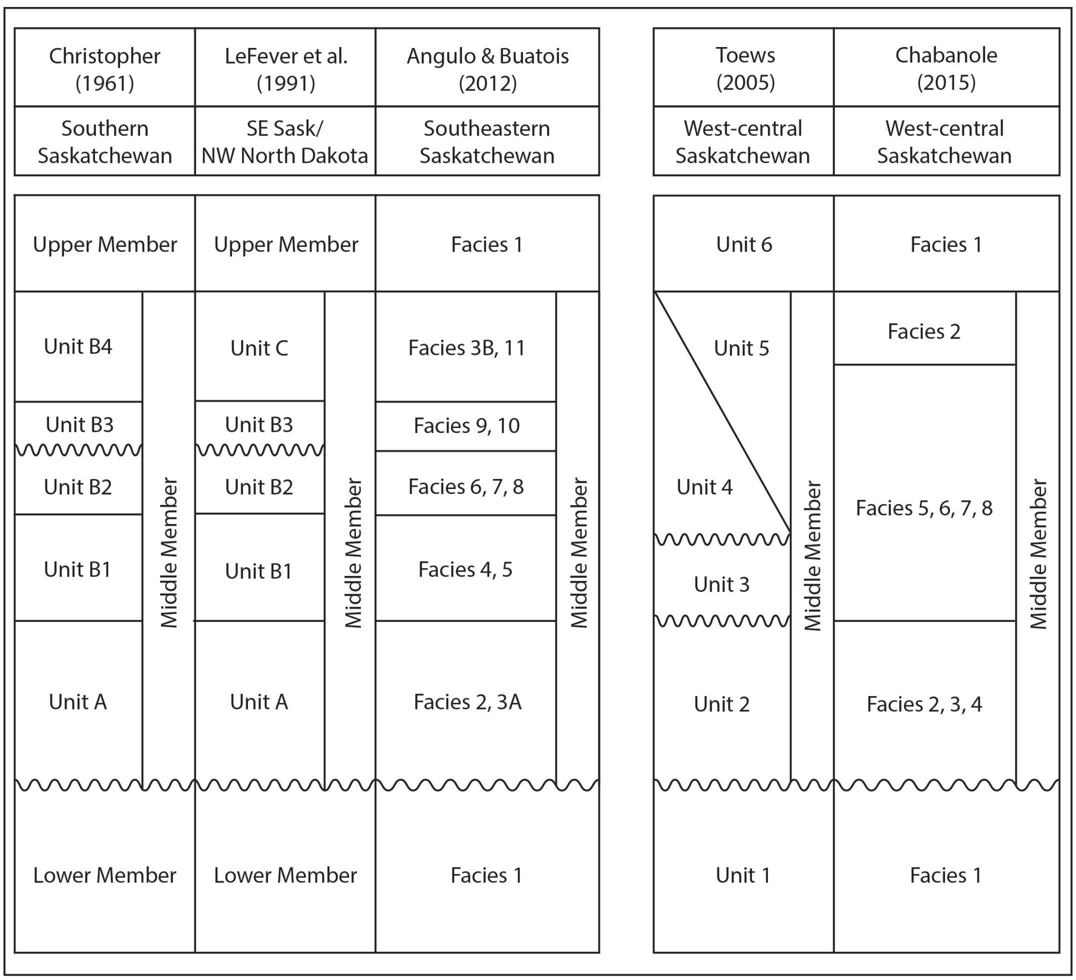

Figure 1.3 – Subdivision of the Bakken Formation throughout the Williston Basin, including this study.

The shoreface model presented by Smith and Bustin (1996) interprets the Bakken Formation as a regressive-transgressive succession, where shoreface deposits initially prograded out across a shallow-marine shelf overlying the Lower Black Shale Member. A subsequent transgression saw the back-stepping of these shoreface deposits, culminating in the deposition of the Upper Black Shale Member.

Angulo and Buatois (2012) proposed a depositional model that involves deposition of open-marine, offshore to lower shoreface deposits occurring during a highstand systems tract following deposition of the Lower Black Shale Member. These open-marine deposits were overlain by a marginal-marine embayment interval deposited during a subsequent transgressive systems tract. Continued transgression led to deposition of an open-marine unit above the embayment deposits.

The depositional models utilizing the tide-dominated scheme are those focused on the Bakken Formation of west-central Saskatchewan. These studies noticed that the major Bakken oil pools in west-central Saskatchewan had a northeast-southwest trend (Figure 1.4). Interpretations vary from open-marine/estuarine (Kasper, 1995) to subtidal open-marine (Toews, 2005).

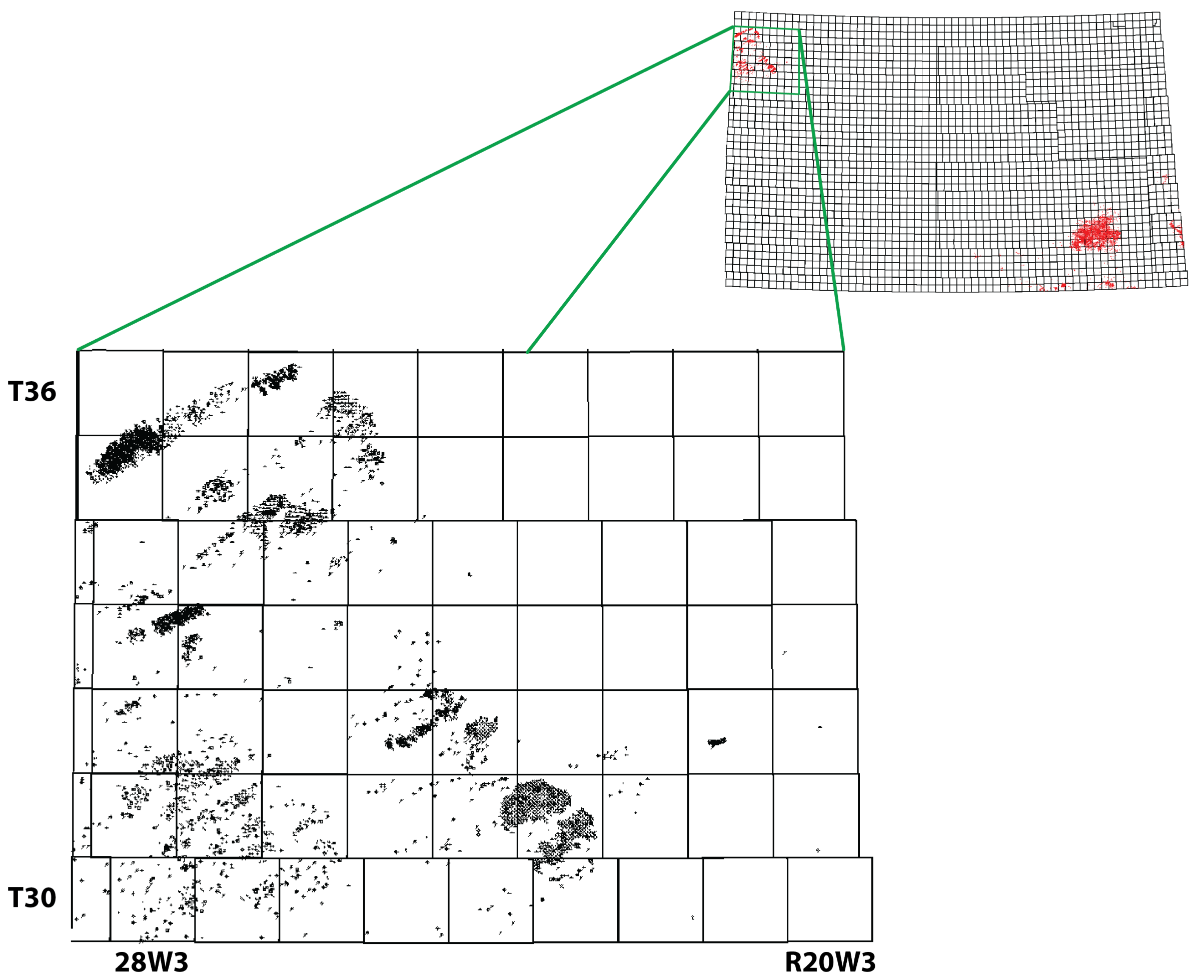

Figure 1.4 – Producing wells from the Bakken Formation, west-central Saskatchewan showing the overall northeast-southwest linear trend of the producing oil pools.

Toews (2005) interpreted the Middle Member as subtidal sand ridges normal to the paleoshoreline with an asymmetric ridge and swale morphology. These linear sandstone bodies were identified as having a common basal surface with ridge thickness increasing towards the northwest. Four transgressive-regressive cycles are interpreted as having taken place during deposition, with each sedimentary unit identified being capped by a flooding surface.

The Bakken Formation of west-central Saskatchewan has undergone significant re-working post-deposition. Although some studies have acknowledged the potential effects of Sub-Cretaceous erosion, none have actually shown to what extent the Bakken Formation of west-central Saskatchewan has been affected by these periods of reworking.

1.3 A Review of Shallow Marine Tide-Dominated Environments

1.3.1 Introduction

Sedimentologists have classically attempted to characterize sedimentary environments based on the interplay of three end-members: tides, waves, and rivers (Figure 1.5). This has resulted in well-developed models when it comes to river-, tide-, and wave-dominated environments as well as environments that record the interplay of these forces such as deltas and estuaries.

The Bakken Formation of west-central Saskatchewan shows sedimentological features characteristic of tide-dominated environments, therefore it is worth reviewing the current way in which tide-dominated environments are classified through a sedimentological lens.

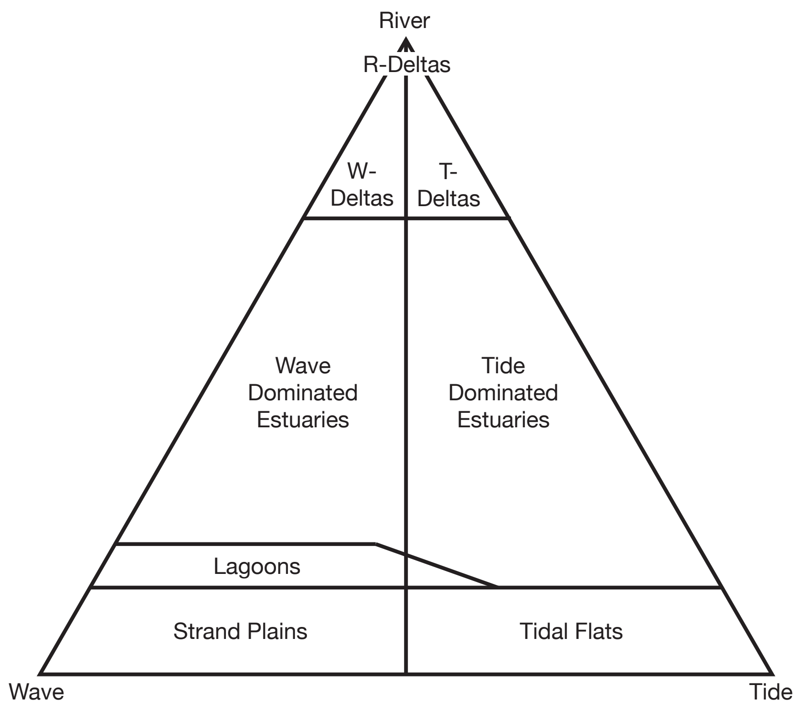

Figure 1.5 – Ternary diagram showing the influence of tides, waves, and rivers on common depositional environments (taken from Harris et al., 2002).

1.3.2 Physical Processes

Dalrymple (2010) defines a tide as a “periodic (regularly repeating) fluctuation in the water level”. These periodic fluctuations in water level are powered by the gravitational attraction of the sun and the moon. Tides result in unidirectional currents created by the Earth-Moon and Earth-Sun systems, which create a vector sum force through the addition of the gravitational attraction of the Sun and Moon to the Earth as well as the centrifugal force created by the rotation of the Earth around the center of mass of the two systems previously mentioned. The Earth-Moon system creates a stronger tidal force than the Earth-Sun system due to the proximity of the moon to the Earth (Figure 1.6).

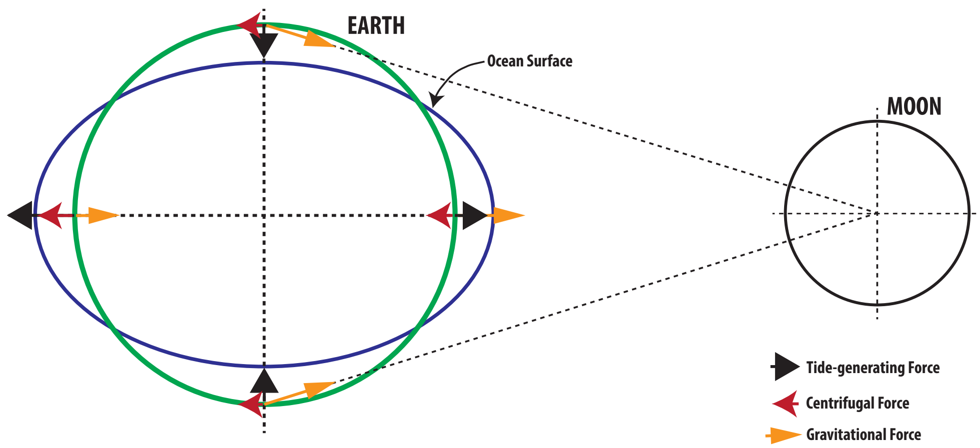

Figure 1.6 – Simplified diagram showing the origin of astronomical tides due to the gravitational attraction of the moon coupled with the centrifugal force on the earth (taken from Dalrymple, 2010).

Tidal range varies across the surface of the Earth. It is subdivided into three main categories: microtidal (0-2 m range), mesotidal (2-4 m range), and macrotidal (>4 m range). Although tidal range is an important factor in governing tidal sedimentation, tidal currents created by tides tend to be what are recorded in the sedimentary record. Most importantly is the fact that unidirectional current direction changes over the course of a tidal cycle. At high and low tide, current speeds are close to zero during which time fine-grained sediments can be deposited through fallout in the water column, resulting in mudstone drapes. Current speeds reach their peak velocity during ebb and flood times as the tides move in and out, which generally results in the deposition of sand-sized sediments. There is often a dominant current direction, where velocity is at its highest, accompanied by a subordinate current direction, where velocity is lower, which can lead to an asymmetry in the thickness of recurring sand layers (Dalrymple, 2010).

Due to the alternation in overall energy throughout tidal cycles, tidal deposits tend to be heterolithic often displaying flaser, wavy, and lenticular bedding (Figure 1.7). However, deposits can also be sand-dominated or mud-dominated depending on where they are located along the depositional profile.

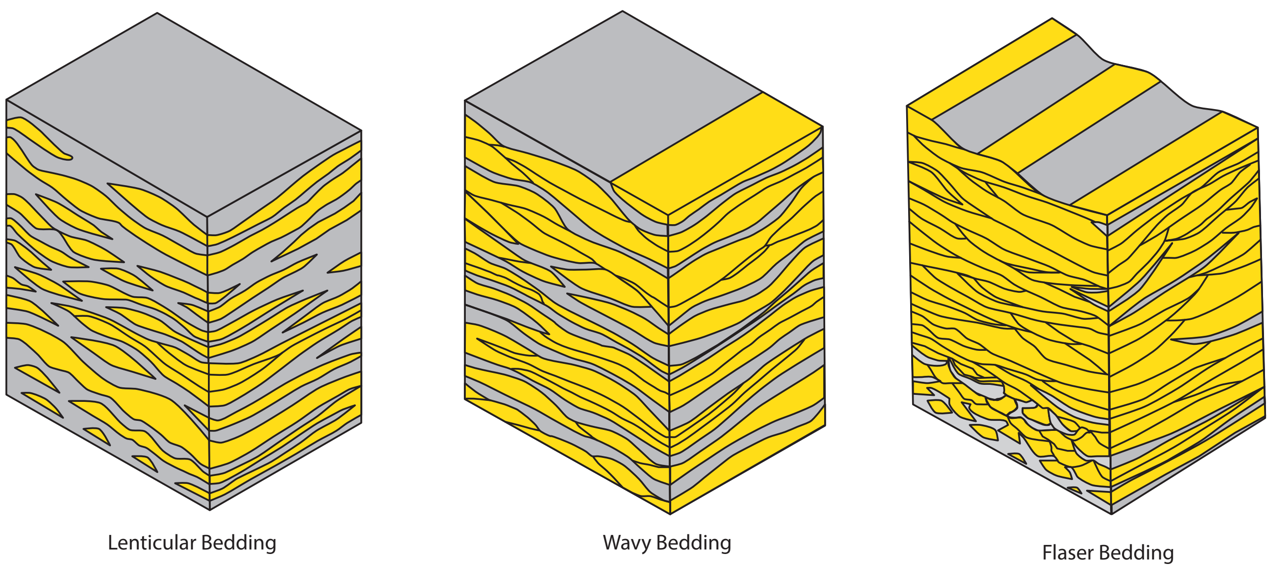

Figure 1.7– Block diagrams displaying the sand to mud ratios of lenticular, wavy, and flaser bedding where sand is yellow and mud is grey (taken from Reineck and Singh, 1980)

1.3.3 Tide-Dominated Depositional Environments

Although tide-dominated environments are diverse, they can be subdivided into three broad morphological sub-environments: tidal channels, tidal flats, and tidal bars (Dalrymple, 2010). These sub-environments can be found along the depositional profile of tide-dominated environments, which is subdivided into subtidal, intertidal, and supratidal (Figure 1.8).

The subtidal zone is located below the low-tide limit where overall energy is at its maximum along the depositional profile, which translates to sand-dominated, large-scale bedforms that migrate across the subtidal zone.

The intertidal zone, which is located between the high- and low-tide limits, is characterized by tidal flats. Tidal flats can be further subdivided into three sub-zones: sand flat, mixed flat, and mud flat. The sand flat is often the most distal sub-zone, which as the name implies, is dominated by sand-sized sediments deposited through bedload traction. The mud flat is the most proximal of the three sub-zones, with deposition of fine-grained muds through suspension fallout being the primary depositional process. Between the sand- and mud-flat is the mixed flat, which displays an alternation of mud and sand deposition. The mixed flat is generally the most heterolithic unit within tide-dominated environments.

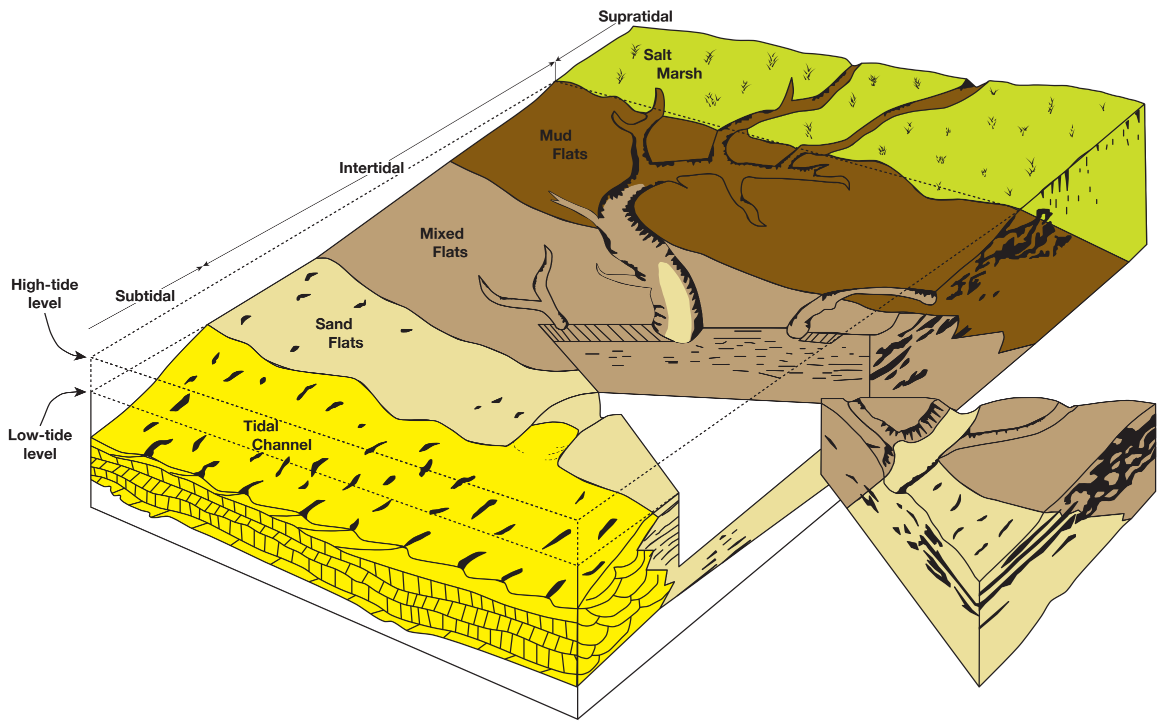

Figure 1.8 – Block diagram showing the subdivision of tidal flat/tidal channel environment along with where they are deposited relative to the high- and low-tide levels (taken from Dalrymple, 2010).

The supratidal zone is located above the high-tide limit. Vegetation often colonizes this zone, with root traces generally obliterating the primary sedimentary fabric. In arid climates where vegetation is less common, evaporate minerals can be deposited within the supratidal zone (Dalrmyple, 2010).

Tidal environments are often channelized, showing similar characteristics to those seen in fluvial environments. Deposition within tidal channels tends to show lateral accretion whereas the areas flanking tidal channels often display vertical accretion. Tidal channels tend to widen seaward due to tidal energy decreasing in a landward direction and can vary in size from < 1 m up to 30 m (Dalrymple, 2010). Channels tend to migrate laterally, although they generally show a higher sinuosity in a landward direction. Lateral migration is attributed to erosion on the outer portion of channel bends similar to that found in fluvial deposits. Lateral accretion within channels is displayed in the form of channel bars that show an erosive base and tend to fine upward (Dalrymple, 2010). Sedimentary structures present in tidal channels are dependent on the overall energy in the system, which is governed by water depth, grain size, and current speed (Dalrymple, 2010); however, they are unidirectional in nature and are often expressed as cross-bedded and current-rippled sandstones.

Tidal channels can also display inclined heterolithic stratification (IHS) (Thomas et al., 1987), which is commonly identified in the Lower Cretaceous rocks of the Mannville Group northwestern Saskatchewan and northeastern Alberta where the oil sands are located. IHS deposits can be sand-dominated or display a much more heterolithic nature with alternating sand and mud deposits. Inclined heterolithic stratification deposits generally display classic point bar morphology, where lateral accretion is the dominant mode of deposition. IHS typically displays a fining-upward trend with respect to grain-size distribution, which is attributed to an overall decrease in energy as you move upward along the point-bar slope (Thomas et al., 1987).

Amos (1995) states that tidal flats occur across shorelines that have a large tidal range. They can be deposited in sheltered settings where they are channel-related or in unsheltered settings where wave-action is present (Dalrymple, 2010). Channel-related tidal flats tend to flank tidal channels and tend to widen in a seaward direction. Moving away from tidal channels, which are sand-dominated, towards the high-tide limit sees a progression from sand-dominated deposition to predominantly mud-dominated deposits. Tidal flats are commonly subdivided into three sub-categories based on their position with relation to the low- and high-tide levels. The lower parts of tidal flats can be expressed as sand-flats, containing cross bedding or ripple cross-lamination, depending on the current speed and grain size present (Dalrymple, 2010). Mixed flats develop landward of the sand flats, commonly displaying alternation of sand and mud, with mud deposition occurring during slack-water deposition. Landward of the mixed flat is the mud flat, which is dominated by suspension fallout of fine-grained sediments (Dalrymple, 2010).

1.4 Review of Ichnology

1.4.1 The Ichnofacies Concept

The study of traces left by animals and plants in sedimentary deposits, such as burrows, trails, trackways, and borings, is formally known as Ichnology (Buatois and Mángano, 2011). It has become increasingly popular as a dataset in sedimentological studies due to the potential for trace fossils to help in the interpretation of environmental conditions during deposition.

In the same vein that sedimentary structures can be classified into facies based on the concept that they were deposited within the same depositional environment, with adjacent deposits having been deposited under different conditions, assemblages of traces interpreted as having been created under similar conditions are broken into ichnofacies.

The ichnofacies model was originally introduced by Dolf Seilacher, who produced a series of papers in which he connected what seemed to be independent observations into a working model now known as the Seilacherian Ichnofacies Model (Seilacher, 1954; 1955; 1958; 1963; 1964; 1967).

The different ichnofacies are identified through key features that are shared by different ichnocommunities. The most referred to ichnofacies are those belonging to the softground marine ichnofacies: *Psilonichnus, Skolithos, Cruziana, Zoophycos*, and *Nereites*. Of these softground marine ichnofacies, all but the *Psilonichnus* ichnofacies (Frey and Pemberton, 1987) were originally proposed by Seilacher. Ichnofacies also exist within the continental realm. These are known as the *Scoyenia, Mermia, Coprinisphaera, Termitichnus, Celliforma, and Octopodichnus-Entradichnus* Ichnofacies (Seilacher, 1967; Smith et al., 1993; Buatois and Mángano, 1995; Buatois et al., 1998a; 1998b; Ekdale et al., 2007; Genise et al., 2000; Hunt and Lucas, 2007; Buatois and Mángano, 2008; Genise et al., 2010)

More recently, the substrate-controlled *Glossifungites* Ichnofacies has also become quite popular within sequence stratigraphic circles due to its potential in identifying surfaces of sequence stratigraphic significance. Other substrate-controlled ichnofacies include *Trypanites, Gnathichnus,* and *Teredolites* (Seilacher, 1967; Frey and Seilacher, 1980; Bromley et al., 1984; MacEachern et al., 1992; Pemberton et al, 1992a; Bromley and Asgaard, 1993; Pemberton et al., 2004; Gibert et al., 2007).

1.4.2 Comparison of *Cruziana* vs. *Skolithos* Ichnofacies

Understanding the key differences between the *Cruziana* and *Skolithos* ichnofacies is important due to the environmental conditions under which they are formed. The *Cruziana* Ichnofacies is an important environmental indicator in the Bakken Formation of west-central Saskatchewan and therefore a comparison of how the *Cruziana* ichnofacies differs from the *Skolithos* ichnofacies is key.

The *Cruziana* Ichnofacies (Figure 1.9) is characterized by the following: (1) dominance of horizontal traces with subordinate vertical traces; (2) a variety of ethological groups such as locomotion, feeding, resting, and dwelling structures; (3) dominance of deposit and grazing traces; (4) the majority of traces being produced by mobile fauna with subordinate permanent domiciles; (5) overall high ichnodiversity; (6) overall high abundance (Buatois and Mángano, 2011). The dominance of horizontal structures that make up the *Cruziana* Ichnofacies are indicative of the food supply most likely being located in the upper parts of the substrate under low to moderate energy conditions. This ichnofacies tends to occur slightly above the fair-weather wave base to just below the storm wave base.

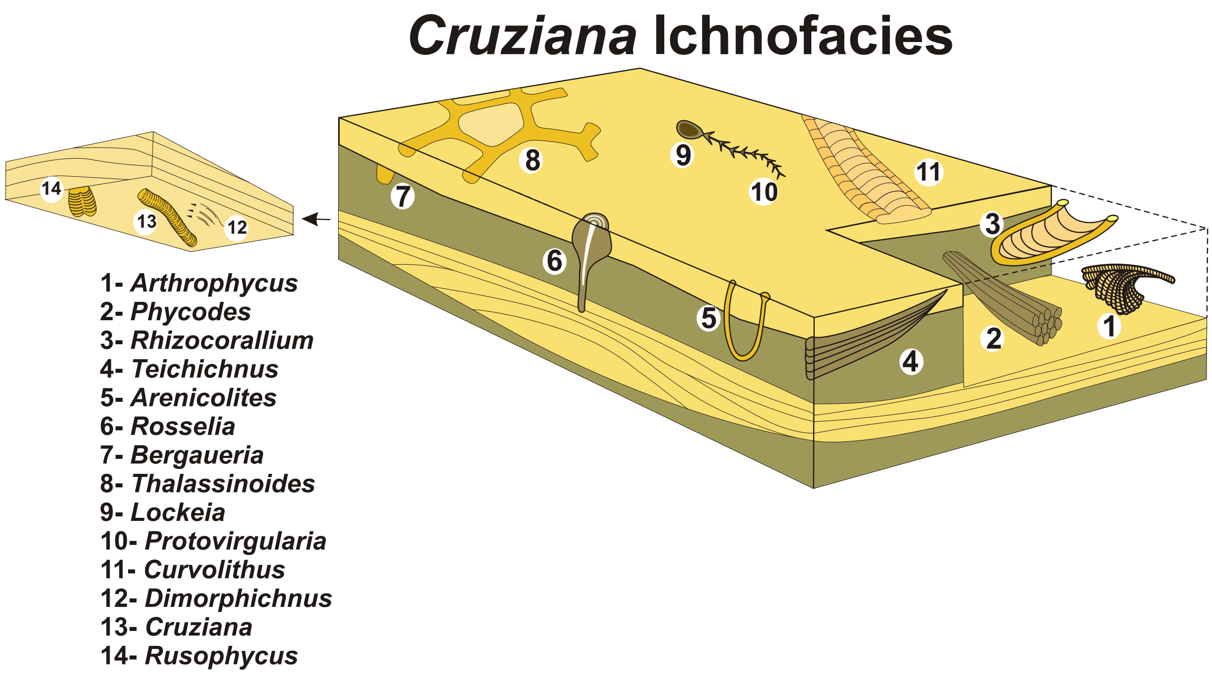

Figure 1.9 – Characteristics of the *Cruziana* Ichnofacies (taken from Buatois and Mángano, 2011)

The *Skolithos* Ichnofacies (Figure 1.10**)** is characterized by the following: (1) dominance of vertical, cylindrical, simple or U-shaped burrows of suspension feeders; (2) presence of spreiten U-shaped equilibrium burrows and escape traces; (3) abundance of three-dimensional burrow systems dominated by vertical components; (4) scarcity of horizontal traces such as those described from the *Cruziana* ichnofacies; (5) low ichnodiversity; (6) variable abundance (Buatois and Mángano, 2011). The dominance of vertical traces created by suspension feeders is indicative of a food supply that is most likely suspended in the water column, which is indicative of consistently high-energy conditions. The *Skolithos* Ichnofacies tends to be found in higher-energy shallow marine environments such as the foreshore to upper- and middle-shorefaces.

The *Cruziana* Ichnofacies is transitional with the *Skolithos* Ichnofacies, with their distribution changing depending on whether the depositional environment is wave-dominated or tide-dominated. Under typical wave-dominated settings (Figure 1.11), where high-energy environments are located closer to the shoreline and energy tends to dissipate seaward, the *Skolithos* Ichnofacies is common in the foreshore to upper- to middle-shoreface. The *Cruziana* Ichnofacies is typically found between the lower-shoreface to the lower offshore where overall energy conditions tend to be decreasing seaward (Pemberton and Frey, 1984; MacEachern and Pemberton, 1992; Pemberton et al, 1992b; Pemberton and MacEachern, 1997; Buatois and Mángano, 2011).

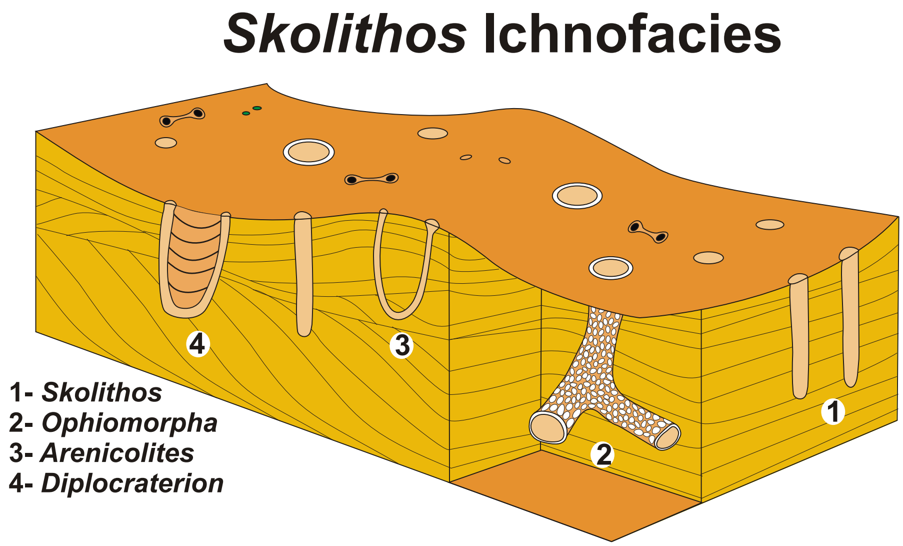

Figure 1.10 – Characteristics of the *Skolithos* Ichnofacies (taken from Buatois and Mángano, 2011)

The overall energy regime in tide-dominated depositional environments is not as linear as that found under wave-dominated settings. Generally speaking, the shallower environments (supratidal to intertidal zone) are deposited under overall low-energy conditions, with energy increasing seaward towards the subtidal zone. Beyond the subtidal zone, low-energy conditions are once again established. Under this model, the *Skolithos* ichnofacies tends to be deposited seaward of the *Cruziana* Ichnofacies, which is the opposite of wave-dominated settings (Mángano and Buatois, 2004; Buatois and Mángano, 2011; Desjardins et al., 2012) (Figure 1.12**)**.

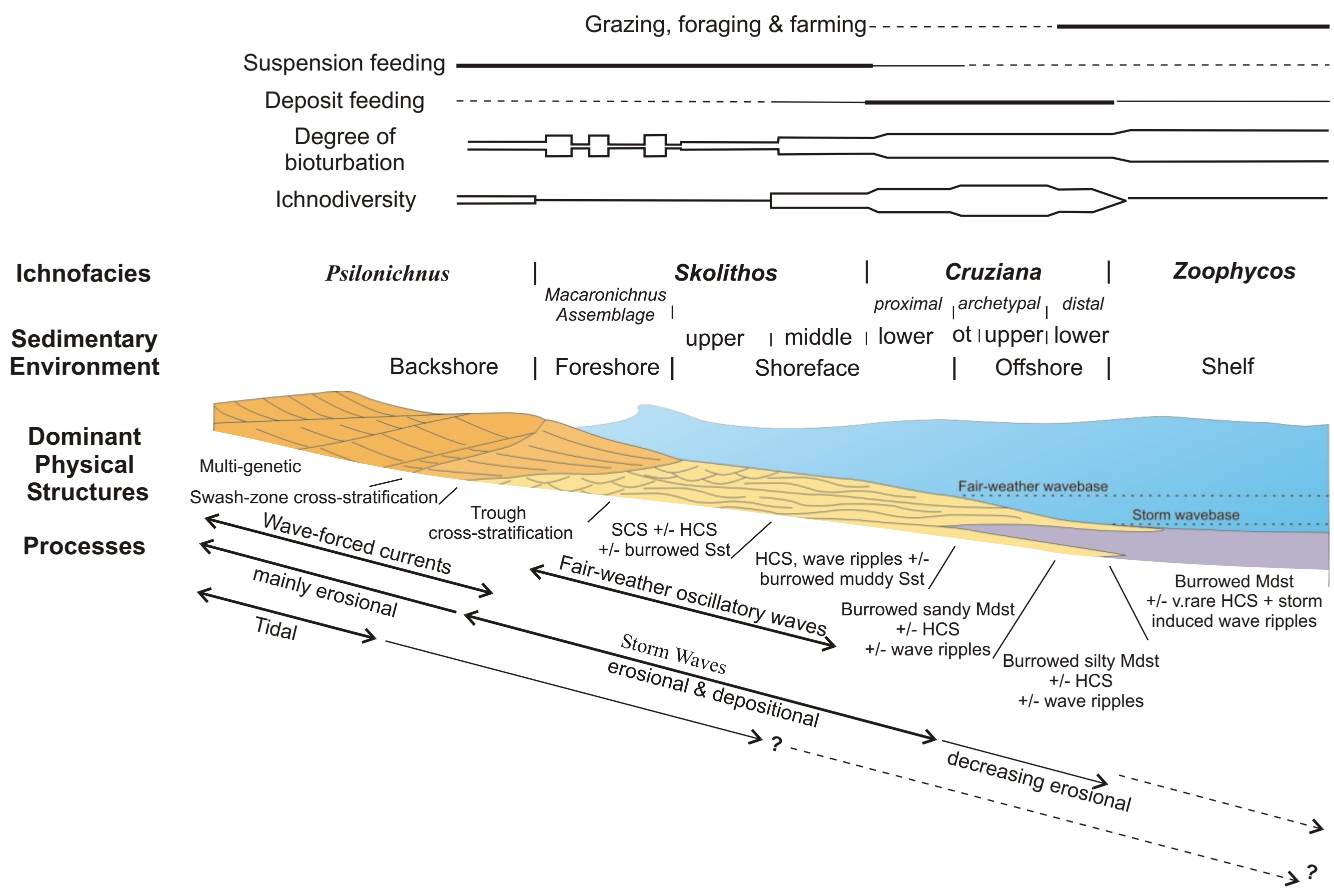

Figure 1.11 – Distribution of the *Cruziana* and *Skolithos* Ichnofacies along a wave-dominated depositional profile (taken from Buatois and Mángano, 2011).

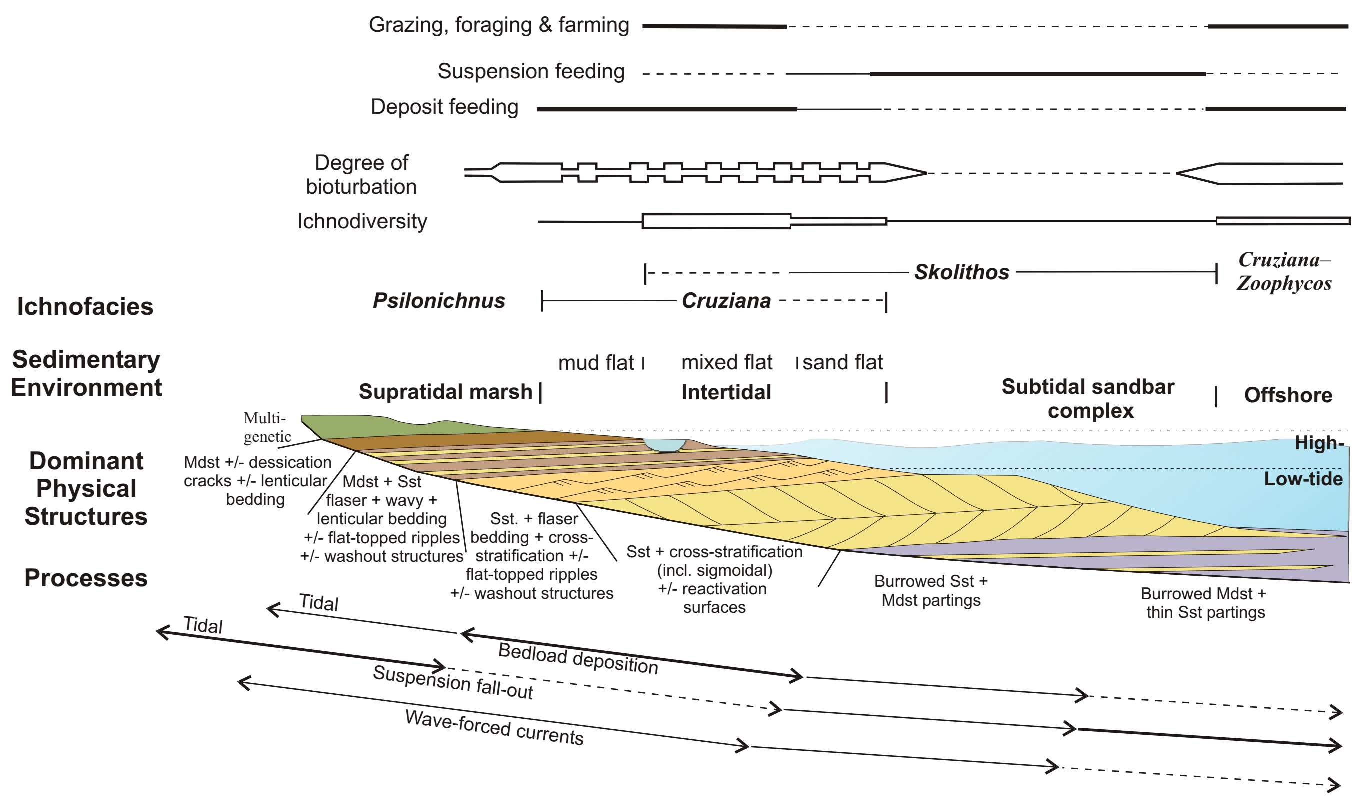

Figure 1.12 – Distribution of the *Cruziana* and *Skolithos* Ichnofacies along a tide-dominated depositional profile (taken from Buatois and Mángano, 2011).

1.4.3 Ichnology of Tide-dominated Environments

The current knowledge with regards to the ichnology of tide-dominated environments is less robust than that of wave-dominated environments (Buatois and Mángano, 2011). Tide-dominated environments do not follow a linear trend when it comes to overall energy conditions such as in wave-dominated environments. This may be a reason for the relative paucity of ichnological information in tide-dominated environments compared to wave-dominated environments.

The currently accepted ichnofacies model for tide-dominated environments follows the same subdivision as described earlier in this thesis, with the subdivision of the depositional profile into supratidal (above the high-tide level), intertidal (between the high- and low-tide level), and subtidal (around and below the low-tide level).

The supratidal zone is characterized loosely by the *Psilonichnus* ichnofacies and grades landwards into terrestrial environments where the *Scoyenia* and *Coprinishpaera* ichnofacies are common (Frey and Pemberton, 1987; Mángano and Buatois, 2004; Buatois and Mángano, 2011; Desjardins et al., 2012).

The intertidal zone, which is subdivided into the distal sand flat, intermediate mixed flat, and proximal mud flat, is a stressful environment for benthic organisms to colonize. This is due to periodic changes in energy, salinity, and subaerial exposure, which in most cases confines organisms to sub-zones within the intertidal zone. The proximal mud flat, where fine-grained sediments are primarily deposited through suspension fallout in the water column, often displays a mottled texture, due to the lack of sand-sized sediments (Buatois and Mángano, 2011). The mixed flat, where sedimentation is at its most heterolithic within the intertidal zone, is characterized by the *Cruziana* ichnofacies – with horizontal traces being preserved at bedding interfaces between sands and muds (Buatois and Mángano, 2011). The sand flat, which is dominated by sand-sized sediments, is the highest energy setting within the intertidal zone and is often characterized by the vertical suspension and dwelling structures of the *Skolithos* ichnofacies. However, the ichnofacies present is a function of the tidal regime, with the *Skolithos* ichnofacies being present within settings under macro- to megatidal regimes. When the tidal range is smaller and overall energy conditions lower, the sand flat can see higher diversity *Cruziana* ichnofacies (Buatois and Mángano, 2011).

The subtidal zone is where the highest energy conditions persist along the depositional profile within shallow-marine tide-dominated environments. This results in the migration of large-scale subtidal dunes that make it hard for benthic communities to establish themselves (Buatois and Mángano, 2011). The vertical traces of the *Skolithos* ichnofacies therefore characterize the subtidal zone within tide-dominated environments, with horizontal trace makers of the *Cruziana* ichnofacies being rare. The highly erosive nature of the subtidal zone along with the constant migration of bedforms allows for preferential preservation of vertical traces over horizontal traces, which creates an incomplete record of the benthic community when analyzing ancient deposits (Desjardins et al., 2010).

1.4.4 The Concept of Ichnofabrics and Bioturbation

The concept of ichnofabrics deals with the texture and internal structure of a substrate as a result of bioturbation (Bromley and Ekdale, 1986). In the ichnofacies approach, only discrete trace fossils that aid in reconstructing depositional environments are taken into consideration whereas under the ichnofabric approach all bioturbation is considered. The cross-cutting relationships and tiering structures are also evaluated under the ichnofabric approach (Buatois and Mángano, 2011).

Taylor and Goldring (1993) proposed what is now known as the Bioturbation Index (BI) to describe the burrow density, amount of burrow overlap, and the sharpness of the original sedimentary fabric to aid in describing bioturbation of sedimentary deposits. This scheme is broken down into the following numerical order: BI = 0 contains no bioturbation; BI=1 (1-4%) is characterized by sparse bioturbation; BI = 2 (5-30%) is characterized by low bioturbation where the primary sedimentary fabric is preserved; BI=3 (31-60%) is characterized by discrete trace fossils accompanied by moderate bioturbation wherein bedding boundaries can still be distinguished; BI=4 (61-90%) is characterized by intense bioturbation with a high diversity of trace fossils where traces often overlap and primary sedimentary structures are often undistinguishable; BI=5 (91-99%) is characterized by intense bioturbation where the sediment is highly reworked, however faint sedimentary fabrics are apparent; BI=6 (100%) is characterized by sediment that has been completely reworked by biogenic activity, where primary sedimentary fabrics are no longer identifiable.

1.5 Study Area

This study focuses on the Bakken Formation of west-central Saskatchewan as it occurs from Range 20W3 to 29W3 (which coincides with the Alberta/Saskatchewan border) and Township 30 to Township 36 along the edge of the Williston Basin (Figure 1.13). The Bakken Formation within the study area is a prolific producer of heavy gravity oil, with notable oil pools including Coleville, Driver, Hoosier, North Hoosier, Fusilier, Loverna, Smiley, Buffalo Coulee, Court, Court West, Plover Lake, Luseland, Hearts Hill, and Cactus Lake.

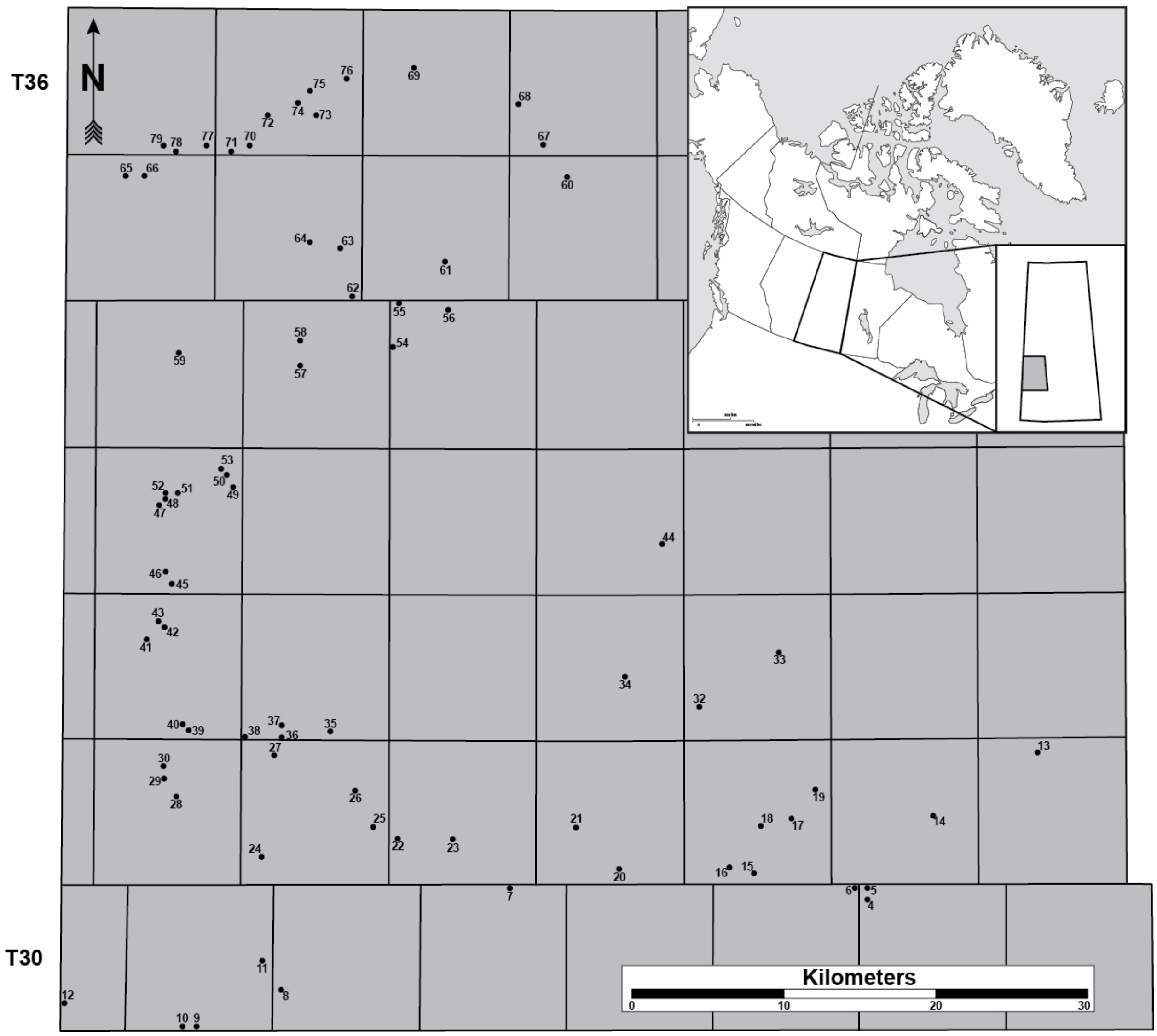

Figure 1.13 – Cores logged within the study area.

1.6 Research Methods

The use of ichnology as a tool in paleoenvironmental reconstructions has become increasingly popular due to it providing an *in situ* record of environmental parameters during deposition (Ekdale et al., 1984; Bromley, 1996; MacEachern and Gingras, 2007; Buatois and Mángano, 2011). Being able to track changes in oxygen content, salinity, and food supply is not possible using primary sedimentary structures (Pemberton et al., 1992a Buatois and Mángano, 2011). However, by integrating ichnologic data with sedimentologic data, it is possible to more accurately constrain depositional environments, which can aid in creating better stratigraphic models (Buatois et al., 2007).

The primary method in defining sedimentary facies for this study is through the detailed description of sedimentary cores. These facies descriptions are then analyzed and interpreted such that they fit into a depositional framework. Seventy-nine cores (Table 1) were described in detail with primary sedimentary structures, bioturbation index, ichnofacies, and bedding contacts used as criteria to define sedimentary facies.

Facies described were then identified on well-logs such that the areal extent of the facies described could be better constrained through the creation of isopach maps using a database that includes the cores logged supplemented by wells where cores were either unavailable or in a condition such that logging was not possible. Well-logs used to identify facies and facies associations include gamma-ray, neutron-density porosity, photo electric, and resistivity logs.

	Well Identification	License Number	Cored Interval Start (m)	Cored Interval End (m)
1	102/11-34-029-25W3/00	97C101	861.0	879.4
2	101/11-18-029-28W3/00	87E067	875.0	884.0
3	111/15-33-029-28W3/00	95K062	785.0	827.0
4	111/06-31-030-23W3/00	00H002	821.0	831.9
5	131/14-31-030-23W3/00	00G222	816.2	834.2
6	131/16-36-030-24W3/00	00I345	821.0	839.8
7	111/15-34-030-26W3/02	84I209	836.1	872.0
8	120/11-07-030-27W3/00	69E092	856.5	872.6
9	131/01-04-030-28W3/02	96F073	788.0	824.0
10	131/03-04-030-28W3/02	95I028	807.0	824.9
11	121/15-13-030-28W3/00	95G289	831.0	849.0
12	131/10-03-030-29W3/03	88E117	860.0	894.0
13	111/06-33-031-22W3/00	98I066	786.0	812.8
14	141/13-14-031-23W3/00	84E090	804.0	821.1
15	111/08-04-031-24W3/00	97J119	824.6	833.7
16	111/09-05-031-24W3/00	97I080	810.0	828.1
17	101/11-14-031-24W3/00	97J258	748.9	827.0
18	111/05-15-031-24W3/02	97H298	807.4	819.8
19	121/14-24-031-24W3/00	55C074	816.9	835.2
20	111/11-03-031-25W3/00	97J323	825.6	842.4
21	111/07-17-031-25W3/00	97H257	846.0	855.0
22	101/14-07-031-26W3/00	80E154	853.3	862.3
23	121/15-09-031-26W3/00	05J091	844.0	860.6
24	101/01-07-031-27W3/00	85J391	869.4	887.6
25	101/06-13-031-27W3/00	73G004	837.6	855.9
26	131/15-23-031-27W3/00	96I073	825.0	834.0
27	121/06-32-031-27W3/00	78G049	840.9	850.3
28	101/11-22-031-28W3/00	96F229	842.0	860.4
29	131/08-28-031-28W3/00	95E024	816.0	831.5
30	101/16-28-031-28W3/00	96F279	829.0	847.2
31	131/16-08-032-21W3/00	98I072	780.0	798.5
32	131/07-07-032-24W3/00	04C316	795.0	813.5
33	121/10-22-032-24W3/00	79B013	796.8	815.0
34	111/10-15-032-25W3/00	95I022	793.0	807.0
35	101/07-03-032-27W3/00	66J082	822.0	840.3
36	101/02-05-032-27W3/00	65I120	848.6	860.8
37	101/10-05-032-27W3/00	65H106	864.1	882.4
38	111/04-06-032-27W3/00	96J090	832.2	850.3
39	101/08-03-032-28W3/00	78I060	776.0	789.4
40	101/10-03-032-28W3/00	66I010	794.6	809.9
41	131/04-28-032-28W3/00	00A182	861.0	874.0
42	131/09-28-032-28W3/00	99K108	865.0	880.0
43	111/15-28-032-28W3/00	99G239	858.0	865.0
44	101/04-13-033-25W3/00	65I067	785.8	812.3
45	111/05-03-033-28W3/00	05B250	855.3	863.8
46	112/16-04-033-28W3/00	05H235	860.0	869.0
47	141/10-21-033-28W3/00	33E067	860.0	868.5

	Well Identification	License Number	Cored Interval Start (m)	Cored Interval End (m)
48	111/16-21-033-28W3/00	94H207	860.0	869.1
49	131/07-25-033-28W3/00	98L030	856.0	865.0
50	101/14-25-033-28W3/00	82C043	850.1	861.1
51	111/03-27-033-28W3/00	94J179	879.0	888.0
52	111/01-28-033-28W3/00	94H171	856.0	865.0
53	101/04-36-033-28W3/00	82K015	858.0	862.6
54	141/04-30-034-26W3/00	00D023	816.0	833.8
55	131/14-31-034-26W3/00	99H097	813.4	830.5
56	111/11-33-034-26W3/00	96J272	821.0	839.0
57	111/06-21-034-27W3/00	96C138	810.0	822.5
58	111/06-28-034-27W3/00	85H187	795.5	810.0
59	141/14-22-034-28W3/00	84H295	896.0	914.1
60	111/03-33-035-25W3/00	06L053	731.0	749.0
61	121/11-10-035-26W3/00	96H056	842.0	849.0
62	111/02-01-035-27W3/00	96H008	828.0	841.0
63	111/04-13-035-27W3/00	00C170	813.0	821.8
64	141/08-15-035-27W3/02	97J079	798.0	816.0
65	121/03-33-035-28W3/02	04F141	883.0	900.0
66	111/04-34-035-28W3/00	96L025	850.0	863.4
67	121/06-05-036-25W3/00	00H210	722.0	738.0
68	101/03-18-036-25W3/00	85B269	737.3	750.8
69	121/12-21-036-26W3/00	01C051	757.0	766.0
70	111/06-05-036-27W3/00	94L013	842.0	850.0
71	111/02-06-036-27W3/00	95E170	832.0	857.5
72	131/12-09-036-27W3/00	00C011	767.0	780.5
73	141/12-11-036-27W3/00	05C278	750.0	770.0
74	131/03-15-036-27W3/00	01A210	738.4	754.0
75	101/09-15-036-27W3/00	00G315	737.0	755.0
76	101/03-24-036-27W3/00	82C024	750.0	759.0
77	101/07-01-036-28W3/00	79I063	818.1	833.5
78	101/03-02-036-28W3/00	80G065	806.5	824.5
79	121/08-03-036-28W3/00	00K119	822.9	830.4

Table 1 – Cores logged for the purposes of this study.

1.6.1 Geological Isopach and Structure Maps

Geological isopach and structure surface maps were created using a combination of the facies/facies association tops recorded during detailed core logging as well as well-log signatures. These tops were recorded in Microsoft Excel and mapped using Golden Surfer 12's kriging algorithm. Datasets from the Government of Saskatchewan (Marsh and Love, 2014) were used to map the structure surface of the underlying Big Valley Formation and overlying sub-Mesozoic unconformity as well as the isopach maps for the Lower and Upper Black Shale Members and overlying Mississippian carbonates.

CHAPTER 2

2. GEOLOGICAL BACKGROUND

The Bakken Formation is restricted to the Williston Basin, which formed the southeastern portion of the Western Canada Sedimentary Basin (Kent and Christopher, 1994). During the Late Devonian to Early Mississippian, the Euramerican continent was bound to the east and west by orogenic activity. Orogenic activity has been linked to the late stages of the Middle to Late Devonian Acadian orogeny in the southern and eastern part of the continent, with the early stages of the Middle Devonian to Early Mississippian Antler orogenic belt flanking the western margin of the Euramerican continent (Figure 2.1). Between these mountain belts was a craton partially submerged by epeiric seas that formed a series of intracratonic and foreland basins, which may have formed in response to the intense orogenic activity ongoing at the continental margins (Ettensohm, 1998). Within the Williston Basin, the thickest accumulations of Bakken Formation sediments occur in the North Dakota and Elbow sub-basins, which were separated by the shallower Swift Current and Melville platforms (Figure 2.2).

The Bakken Formation is the youngest unit of the Devonian-Mississippian Three Forks Group, which consists of the Torquay Formation, Big Valley Formation, and Bakken Formation. The Bakken Formation unconformably overlies the pale green shales of the Big Valley Formation throughout much of the Williston Basin (Kreis et al., 2006; Nickel, 2010). The Big Valley Formation also occurs as a crystal limestone in the western part of Saskatchewan, directly underlying the Bakken Formation (Christopher, 1961). In the furthest eastern parts of the Williston Basin, near the depositional edges of the basin, the Bakken Formation can unconformably overlie the weathered dolostones of the Upper Devonian Torquay Formation (Kreis et al., 2006).

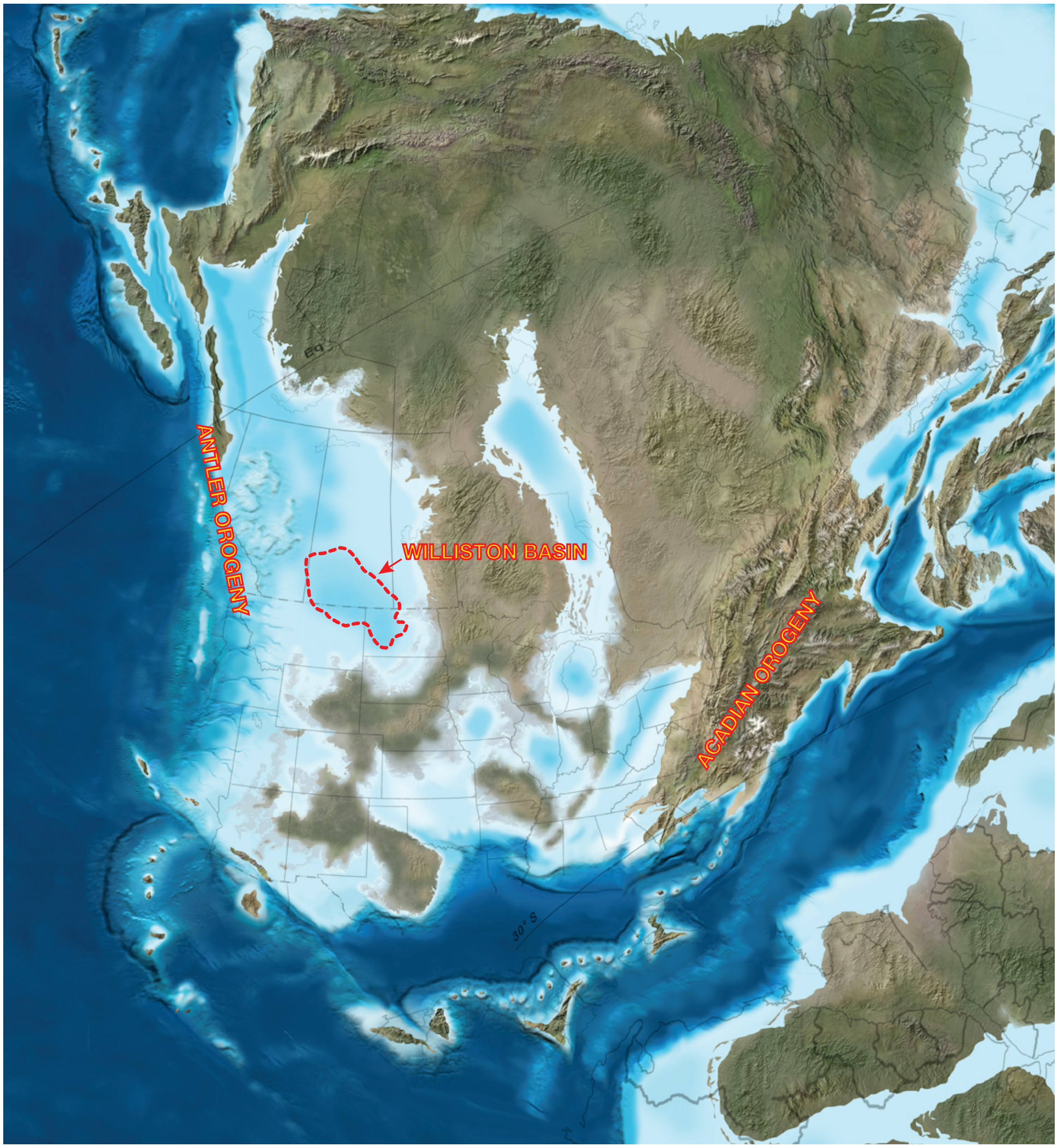

Figure 2.1 – Location of the Williston Basin during the Late Devonian within the Euramerican continent. The Acadian and early Antler Orogenies are labeled, illustrating the Euramerican continent bound at the eastern and western margins by orogenic activity (After Blakey, 2013).

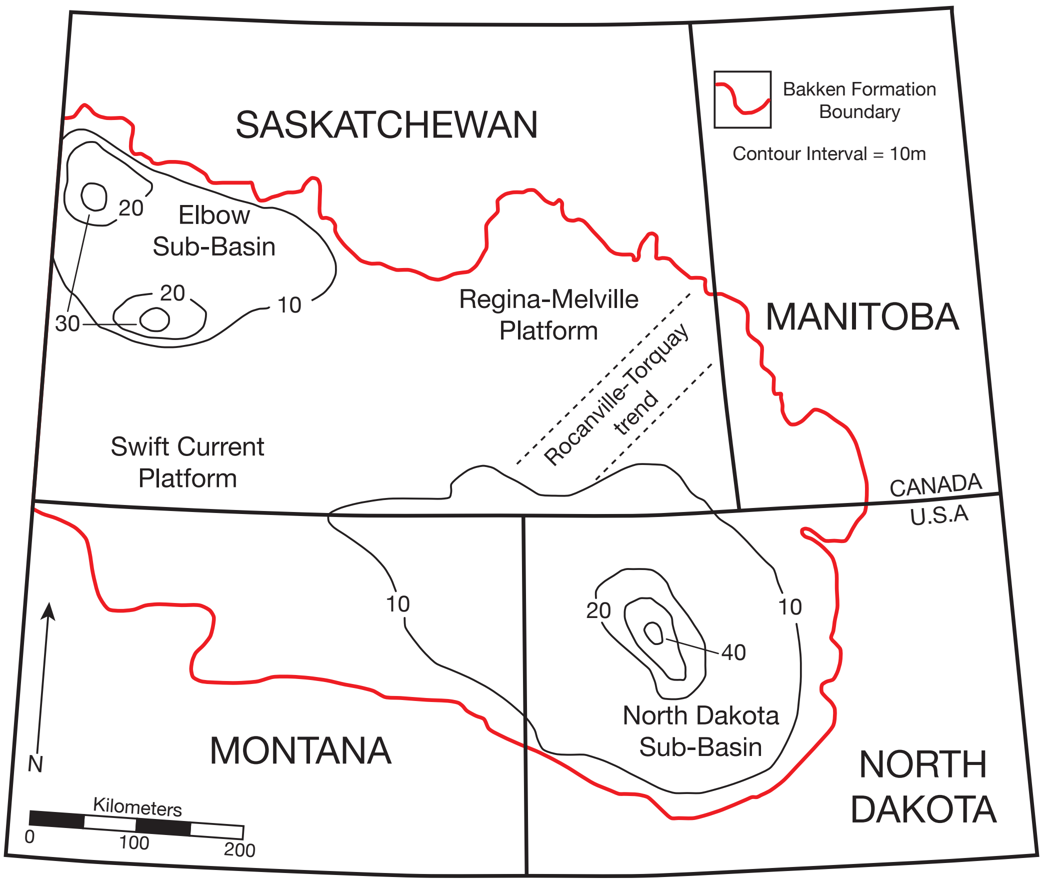

Figure 2.2 – Map showing the distribution of the Bakken Formation within the North Dakota and Elbow Sub-Basins, separated by the Swift Current and Regina-Melville Platforms (After Smith and Bustin, 1996).

The Bakken Formation is conformably overlain by the Mississippian Madison Group carbonates throughout the majority of the Williston Basin. In west-central Saskatchewan, these shallow-water carbonates are often missing, which has been attributed to widespread sub-Mesozoic erosion (Christopher, 1961; 2003). The Jura-Cretaceous Success Formation or, more commonly, the Lower Cretaceous clastics of the Mannville Group therefore often unconformably overlie the Bakken Formation in west-central Saskatchewan.

The Bakken Formation has previously been referred to as the perfect hydrocarbon system (Halabura et al., 2007) in that it comprises the source rock, reservoir, and seal within the formation itself. Previous studies have reported that the Black Shale Members were not thermally mature enough within Saskatchewan to have been considered source rock, with the only part of the Williston Basin deep enough to attain thermal maturity being located in North Dakota (Osadetz et al., 1992; Osadetz and Snowdon, 1995; Stasiuk and Fowler, 2004). However, more recent studies have stated that the black shales of the Bakken Formation within southeastern Saskatchewan may have served as source rocks due to high levels of organic sulphur, known as Type II-S kerogen, which can generate hydrocarbons at lower levels of thermal maturity (Aderoju and Bend, 2012).

In west-central Saskatchewan, the hydrocarbons being produced are considered heavy oil (12° API), which are far different from the light oil being produced in southeastern Saskatchewan and northern North Dakota. The Exshaw Formation, which is the age equivalent to the Lower Black Shale Member, in Alberta has previously been identified as the source rock for the Bakken Formation as well as for the overlying heavy oil deposits of the Lower Cretaceous Mannville Group (Obermajer et al., 2004). The low gravity of these oils is attributed to biodegradation. However, biodegradation is only thought to have been light to moderate (Obermajer et al., 2004).

CHAPTER 3

3. SEDIMENTARY FACIES AND FACIES ASSOCIATIONS

3.1 Introduction

The Bakken Formation of west-central Saskatchewan is subdivided into three members similar to other parts of Saskatchewan, with the Lower and Upper Members composed of black shale and a Middle Member composed of sandstone, siltstone, mudstone, and carbonate.

Eight facies have been defined based on primary sedimentary structures and ichnological characteristics described through detailed analysis of cores from the study area. Facies 1 (F1) is comprised of the Lower and Upper Member Black Shales. The Middle Member comprises Facies 2 through 8. Facies 2 (F2) has been subdivided into Subfacies 2A (Bioturbated siltstone) and Subfacies 2B (Bioturbated sandy-siltstone). The remaining facies of the Middle Member are Facies 3 (F3) (wavy-laminated very fine-grained sandstone), Facies 4 (F4) (bioclastic grainstone), Facies 5 (F5) (interbedded mudstone/very fine- to fine-grained sandstone), Facies 6 (F6) (very fine- to fine-grained sandstone), Facies 7 (F7) (bioturbated siltstone/very fine-grained sandstone), and Facies 8 (F8) (massive and brecciated siltstone).

Each facies is described in detail followed by an interpretation of the inferred depositional environment. Sedimentological attributes include lithology, grain size, primary sedimentary structures, as well as the nature of bedding contacts. Ichnological analysis includes the identification of trace fossils present as well as the bioturbation index (BI) outlined by Taylor and Goldring (1993).

3.2 Facies 1: Black Shale (Lower and Upper Members)

3.2.1 Facies 1 Description

Facies 1 is characterized by black, massive to parallel-laminated shale (Figure 3.1). Bioturbation is not apparent. Silt and very fine-grained sandstone are visible within laminar interfaces. Pyrite is locally common both in disseminated and nodular form. Fractures and, to a lesser extent, bedding surfaces can be infilled with calcite. Bioturbation is absent (BI = 0) throughout both the Lower and Upper Members.

The lower contact of the Lower Member with the underlying Big Valley Formation is at times irregular, but typically sharp. The upper contact of the Lower Member with the overlying Middle Member is variable depending on which facies it is overlain by. This contact varies from gradational (Subfacies 2A) to irregular (Facies 4). The lower contact of the Upper Member with the underlying Middle Member is generally sharp when Subfacies 2A is directly underlain. The upper contact of the Upper Member is generally sharp and can appear erosive with the shallow water carbonates of the overlying Mississippian Madison Group.

The Lower and Upper members have a very distinct signature on geophysical well-logs due to the high TOC of the black shales (Figure 3.2). The shales generally show very high gamma-ray values (>250 GAPI). The Lower Member serves as a consistent geophysical marker across the study area, but the Upper Member is less consistent due in part to sub-Mesozoic erosion, but also perhaps due to non-deposition.

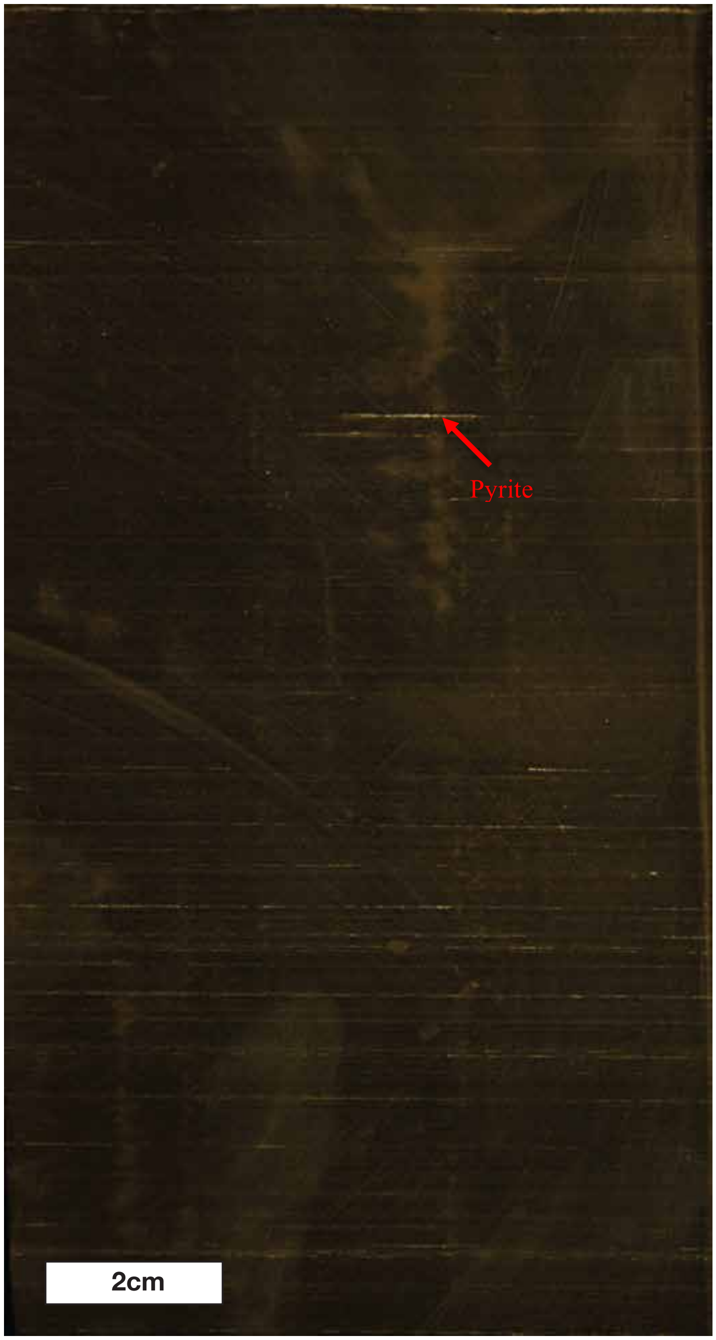

Figure 3.1 – Core photograph of F1 (Upper and Lower Black Shale Members) displaying black color and parallel laminations. Pyrite is visible along laminar planes (Well 10-03-030-29W3 at 864.50 m).

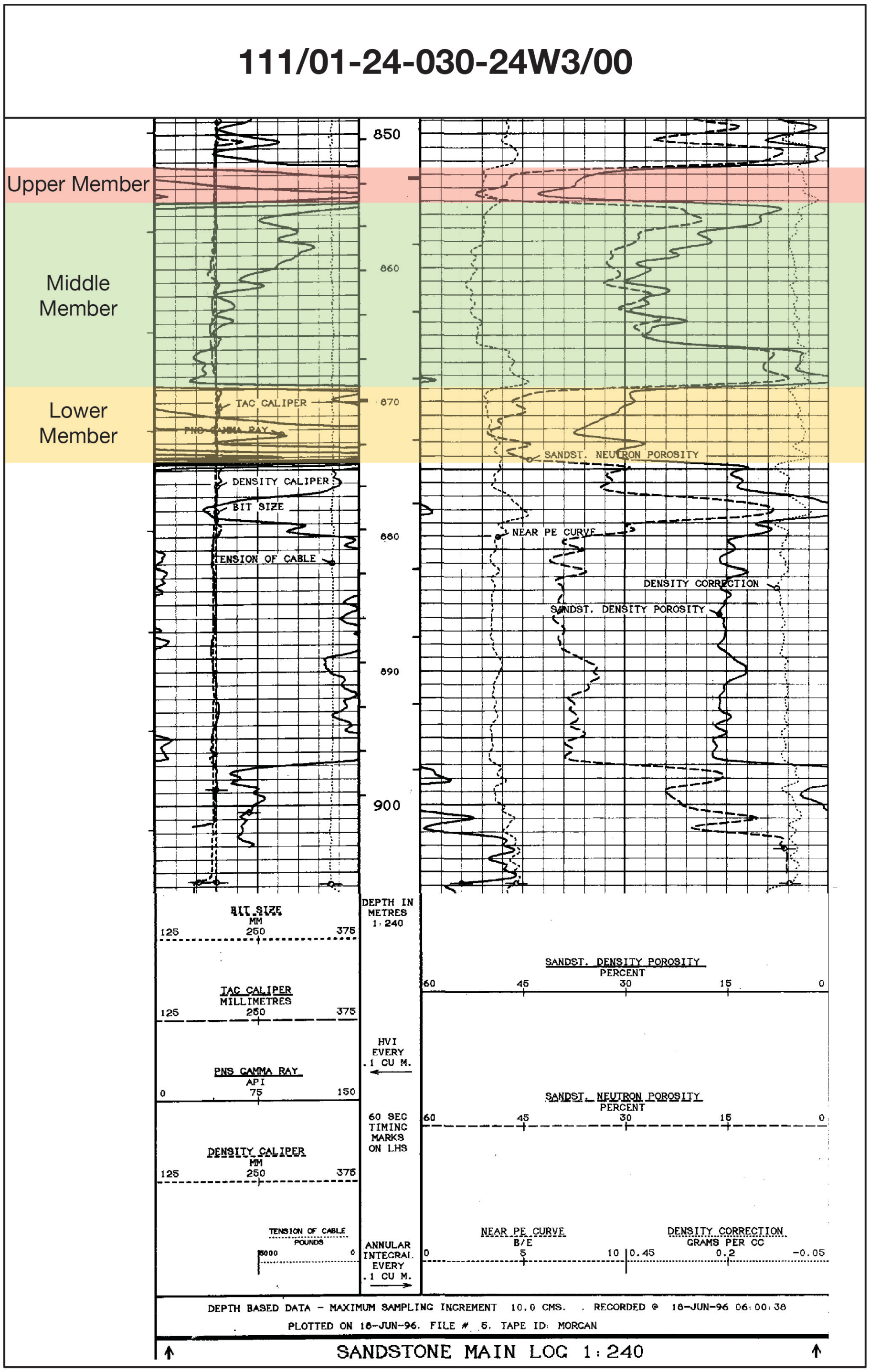

Figure 3.2 – Geophysical well-log showing high gamma-ray signatures characteristic of the black shales from the Bakken Formation.

3.2.2 Facies 1 Interpretation

Facies 1 is interpreted as having been deposited in a low-energy environment, where suspension fallout was the dominant mode of deposition. This is evidenced by the parallel-laminated nature of the unit, which is inferred to be due to deposition below storm wave base. The lack of current and oscillatory sedimentary structures is also evidence for overall quiet energy conditions (Caplan and Bustin, 1996; 1998; Smith and Bustin, 1996). Stasiuk (1996) described the presence of *Tasmanites* in the black shale members of the Bakken Formation in southeastern Saskatchewan as evidence of an overall low-energy setting in the distal reaches of the basin. The black color and general lack of bioturbation is attributed to dysoxic-anoxic conditions, which could have occurred in a low-energy environment. The locally common occurrence of pyrite, both nodular and disseminated, points towards reducing conditions during deposition, which further illustrates dysoxia during deposition. Furthermore, Egenhoff and Fishman (2013) described burrows in the Upper Black Shale Member in the United States, suggesting that dysoxic rather than anoxic conditions were prevalent during deposition of F1.

Although overall low energy conditions dominated during deposition of the Lower and Upper Members, the presence of very fine-grained sandstone and siltstone at laminar interfaces suggests that coarser-grained sediments were at times deposited, perhaps transported by low-density turbidity currents.

3.3 Facies 2 – Bioturbated Siltstone/Sandy-Siltstone

Facies 2 has been subdivided into two subfacies: Subfacies 2A (Sbf2A) is a bioturbated siltstone and Subfacies 2B (Sbf2B) is a bioturbated sandy-siltstone.

3.3.1 Subfacies 2A (Bioturbated siltstone) Description

Subfacies 2A is characterized by a greenish-grey siltstone with rare very fine-grained sandstone horizons (Figure 3.3). It is generally calcareous in nature with both articulated and disarticulated brachiopod shells as well as crinoid ossicles. Subfacies 2A commonly contains both disseminated and nodular pyrite. Primary sedimentary structures are completely reworked by moderate to heavy bioturbation with a bioturbation index (BI) ranging from 3-5. The background bioturbation of Subfacies 2A is difficult to identify; however, *Phycosiphon incertum* can locally be identified. *Nereites missouriensis* is also present, generally in high densities in discrete horizons.

The lower contact of Subfacies 2A with Facies 1 is generally sharp. The transition between Subfacies 2A and 2B is gradational, which is in part why the subdivision has been made.

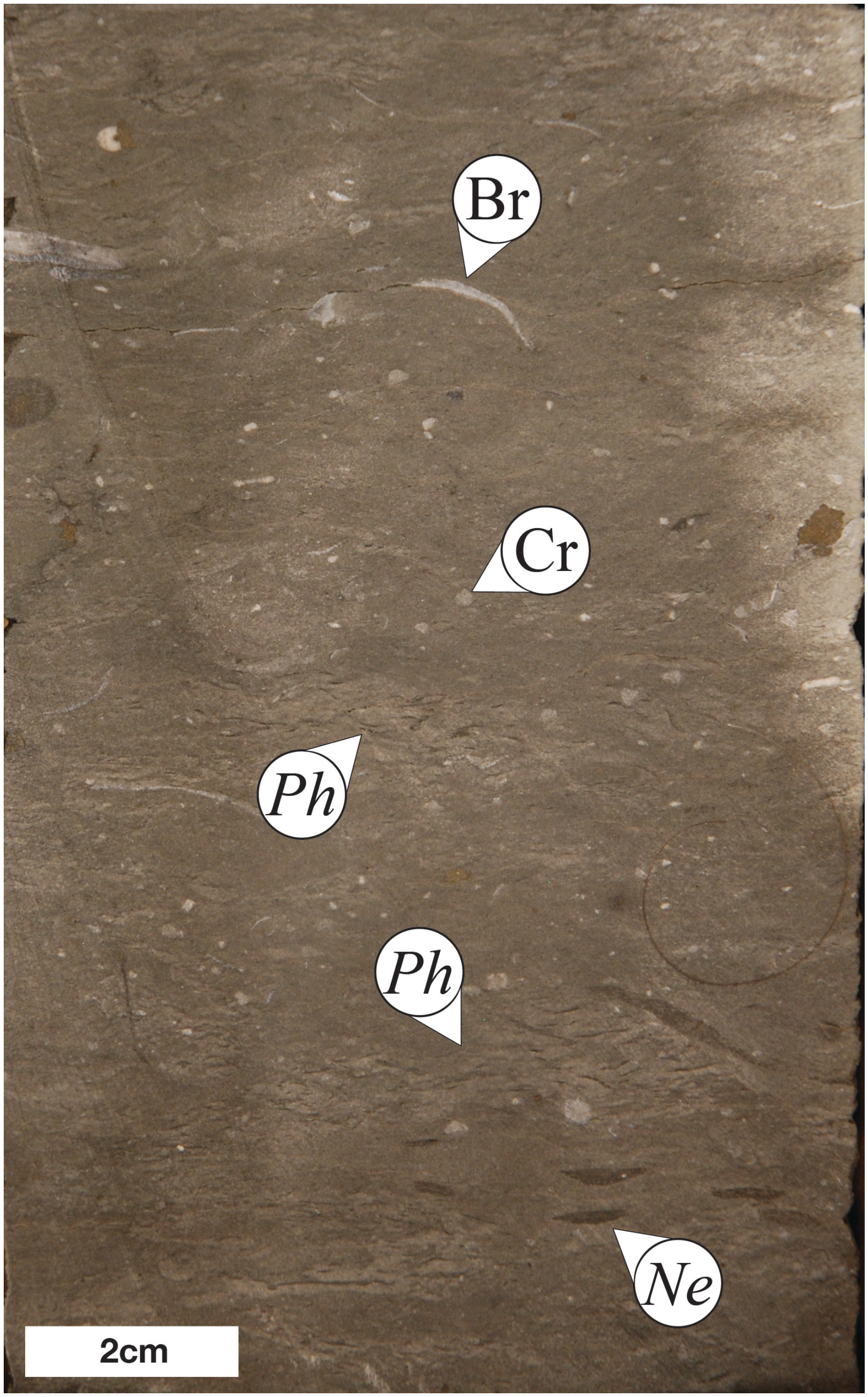

Figure 3.3 – Core photograph of Sbf2A showing heavily bioturbated sediment where the primary sedimentary fabric has been completely reworked. *Nereites missouriensis* (*Ne*) and *Phycosiphon incertum* (*Ph*) form the ichnofabric. Crinoid ossicles (Cr) and brachiopod (Br) shells are also visible (Well 06-32-031-27W3 at 849.30 m).

3.3.2 Subfacies 2A Interpretation

Subfacies 2A is interpreted as having been deposited in an overall low-energy environment where suspension fallout is the dominant mode of deposition. The presence of brachiopod shells and crinoid ossicles coupled with the moderate to high level of bioturbation is evidence of a well-oxygenated environment where organisms were able to thrive. The intensity of bioturbation is also indicative of overall low-energy conditions. The presence of *N. missouriensis*, a horizontal grazing trace fossil is evidence for an environment where the food supply is mostly likely contained within the sediment and not suspended in the water column, which is further evidence for an environment where suspension fallout dominated. Thin, very fine-grained sandstone intervals may be attributed to periodic deposition by distal storms. This may also indicate deposition at or near the storm wave base, specifically in a lower-offshore.

3.3.3 Subfacies 2B (Bioturbated sandy-siltstone) Description

Subfacies 2B (Sbf2B) is similar to Subfacies 2A, but it has a noticeably higher sand content (very fine-grained, pale grey color). Such as in Subfacies 2A, primary sedimentary structures have been reworked by biogenic activity, resulting in diffuse bed boundaries, with a bioturbation index of 3-5. The ichnofabric differs from Subfacies 2A in that *N. missouriensis* becomes the dominant ichnotaxa with subordinate *Asterosoma* isp. and rare *Phycosiphon incertum*. The abundant brachiopod fragments and crinoid ossicles from Subfacies 2A also become rare (Figure 3.4).

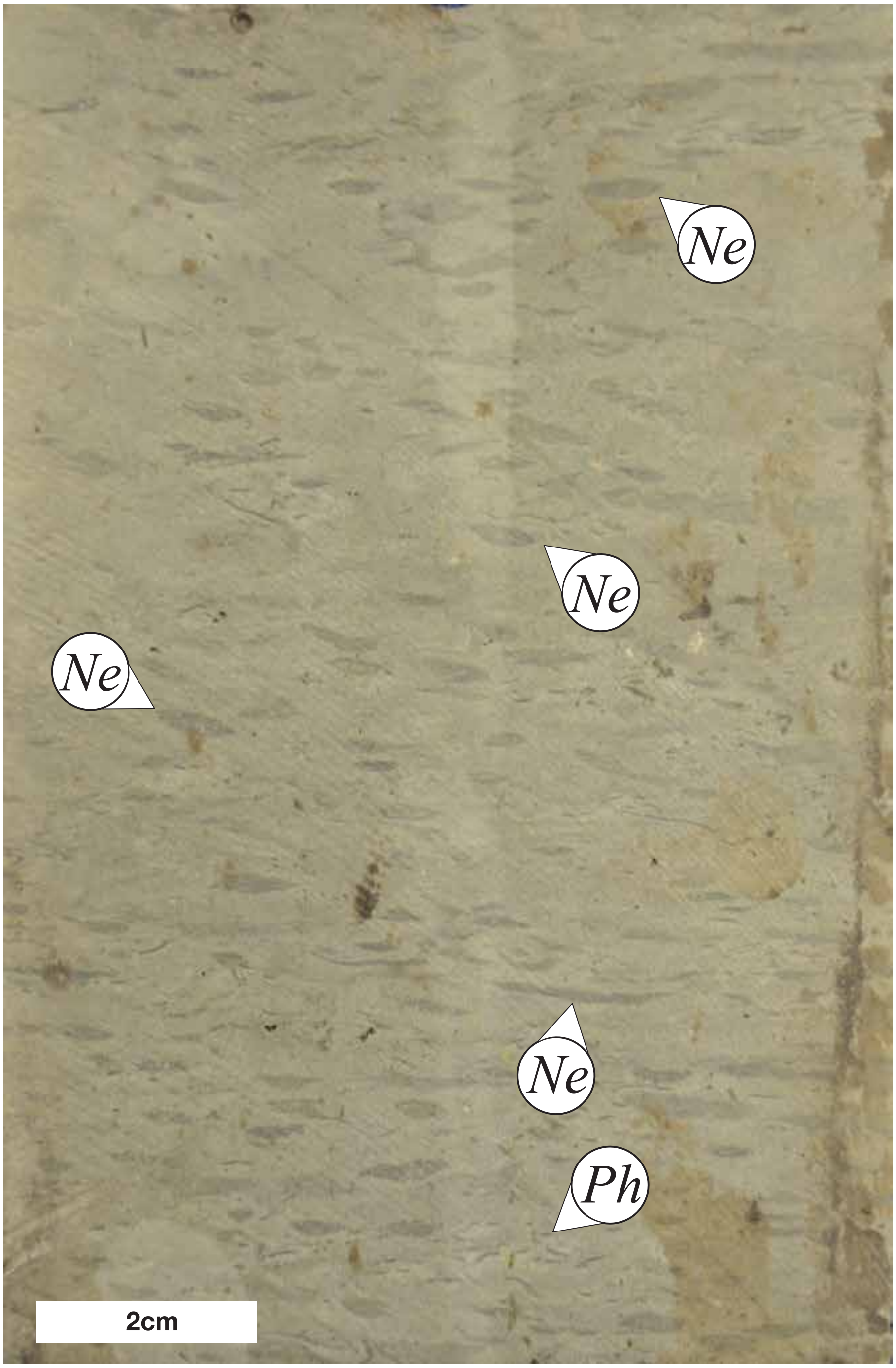

Figure 3.4 – Core photograph of Sbf2B showing the sandier nature relative to Sbf2A. *Nereites missouriensis* (*Ne*) becomes the dominant ichnotaxa with subordinate *Phycosiphon incertum* (*Ph*) (Well 12-16-031-23W3 at 815.00 m).

3.3.4 Subfacies 2B Interpretation

The higher sand content in Subfacies 2B relative to Subfacies 2A is evidence of somewhat higher overall energy conditions and emplacement in a more proximal position. The siltstone intervals are interpreted as having been primarily deposited through suspension fallout, with the sandier intervals having been generated by storm activity. However, the lack of any primary sedimentary structures makes it difficult to fully attribute sand content to storm activity. The moderate to high level of bioturbation indicates a well-oxygenated water column in which organisms were able to thrive. The predominance of *Nereites missouriensis*, a horizontal grazing trace, is evidence for a food supply that is primarily hosted within the sediment and not suspended within the water column. However, the more complex trails made up by this trace is indicative of a food supply that is not as well distributed as in Subfacies 2A. A lack of oscillatory structures, coupled with the overall horizontal nature of the ichnofabric suggests deposition beneath fair weather wave base. The higher sand content, however, appears to indicate deposition above the storm wave base, with periodic storms bringing very fine-grained sand into the system, placing Subfacies 2B in the upper offshore to offshore transition.

3.4 Facies 3 – Wave-rippled Very Fine-grained Sandstone

3.4.1 Facies 3 Description

Facies 3 (F3) is characterized by very-fine grained sandstone with wave-ripples as well as oscillatory sedimentary structures (Figure 3.5). Ripples are predominantly symmetrical. Thin (1-5 cm) muddy intervals are present, albeit rare. These mud-rich horizons do not display any particular rhythmicity. Bioturbation is absent in Facies 3, with a bioturbation index (BI) of 0. Body fossils have not been identified. The lower contact of Facies 3 with Facies 2 is gradational.

3.4.2 Facies 3 Interpretation

The overall sandy nature of Facies 3 indicates relatively constant agitation of the substrate, which is further evidenced by the almost ubiquitous presence of symmetrical ripples and oscillatory sedimentary structures. Muddy intervals, although few, are indicative of periods of quiescence where fine-grained material was able to settle. The fact that these muddy lenses are never thicker than 5 cm is further evidence that the water column was more or less continuously under the effects of wave action. The lack of bioturbation is also indicative of high-energy conditions, with sand bodies migrating across the sea floor too quickly to allow for colonization of the substrate. Commonly, sand-dominated environments dominated by amalgamated hummocky cross-stratified sandstone fall within the middle to lower shoreface. However, F3 does not appear to display hummocky cross-stratification, which is also a common component observed within the middle to lower shoreface (Walker and Plint, 1992). This lack of HCS can be attributed to the overall shallow setting and low-energy conditions of the Williston Basin. The preservation of, albeit rare, mudstone layers indicate deposition within the lower shoreface, at or near fair-weather wave base, where rare periods of low energy allowed for deposition through suspension fallout. Facies 3 is therefore being interpreted as having been deposited in a lower to middle shoreface setting, at or near fair-weather wave base.

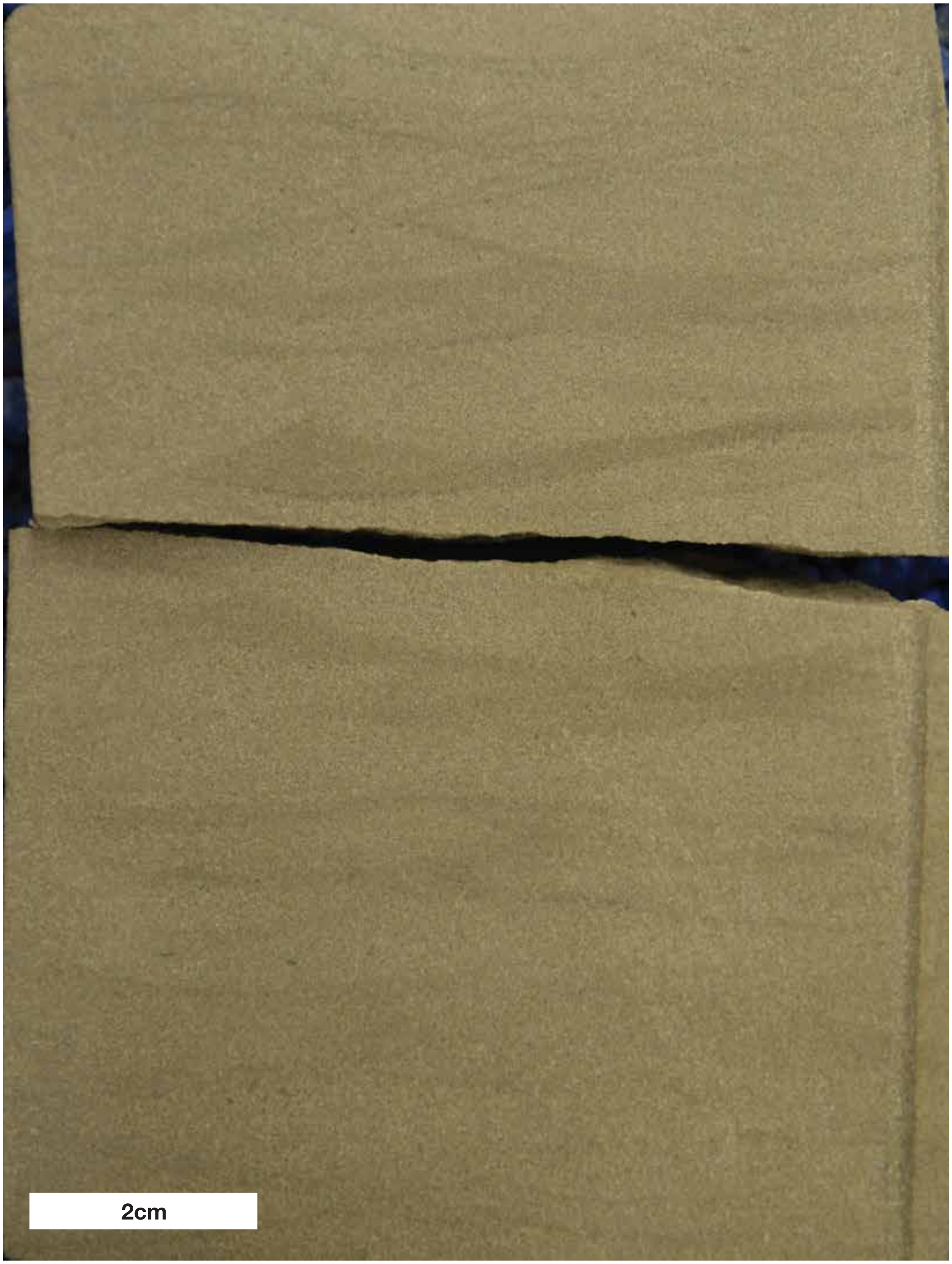

Figure 3.5 – Core photograph showing oscillatory wave-ripples characteristic of F3 (Well 10-03-030-29W3 at 869.00 m).

3.5 Facies 4 – Bioclastic Grainstone

3.5.1 Facies 4 Description

Facies 4 (F4) is characterized by an abundance of bioclasts, including brachiopod shells, both articulated and disarticulated, and crinoid ossicles (Figure 3.6). Bioclasts are 0.2-2.0 cm wide (averaging 0.5 cm). Bioclasts are hosted in fine-grained, grey calcareous cement.

Facies 4 has an overall massive appearance and generally fines upward in thicker successions. Planar horizontal laminations and high-angle cross stratification are locally present (Figure 3.7). In these finer-grained intervals, silt and fine-grained sand appear to increase, but it is difficult to distinguish between heavily reworked bioclasts and clastic material.

Facies 4 is laterally patchy and is restricted to the southeastern part of the study area. Facies 4 typically overlies the Lower Black Shale Member (Facies 1). The contact is highly erosive, at times showing an almost sigmoidal shape.

3.5.2 Facies 4 Interpretation

Facies 4 was most likely deposited in a shallow water shoal environment. These shallow water shoals appear to have been controlled by local bathymetry. The erosive nature of the lower contact of Facies 4 with the upper contact of the Lower Black Shale Member is most likely just a characteristic of the high-energy system represented by Facies 4 and should not be considered as evidence of an unconformity between the Lower Black Shale Member and the Middle Member.

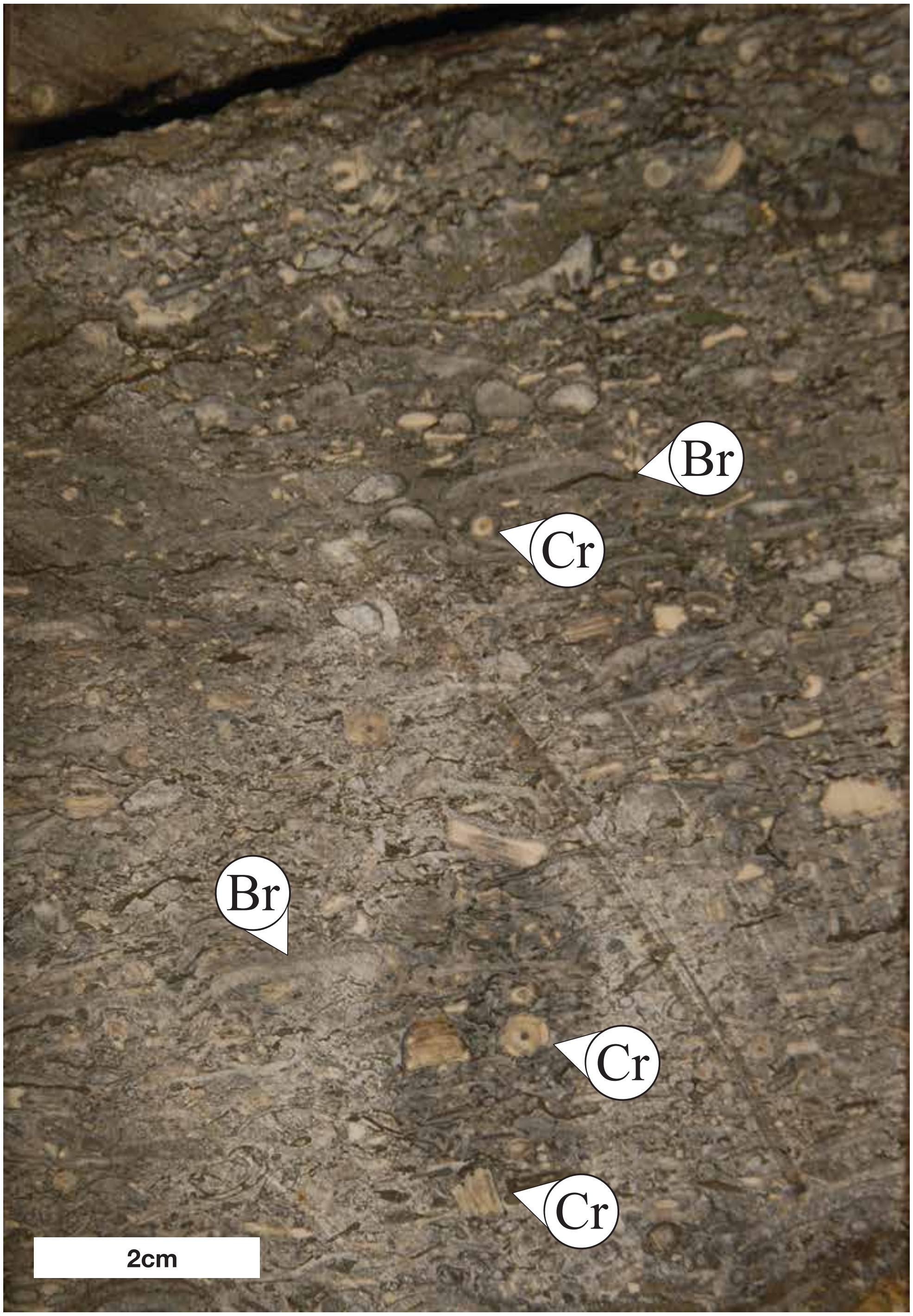

Figure 3.6 – Core photograph of F4, characterized by a bioclastic grainstone showing abundant fragmented body fossils, including brachiopod (Br) and crinoid (Cr) fragments (Well 15-09-031-26W3 at 859.60 m).

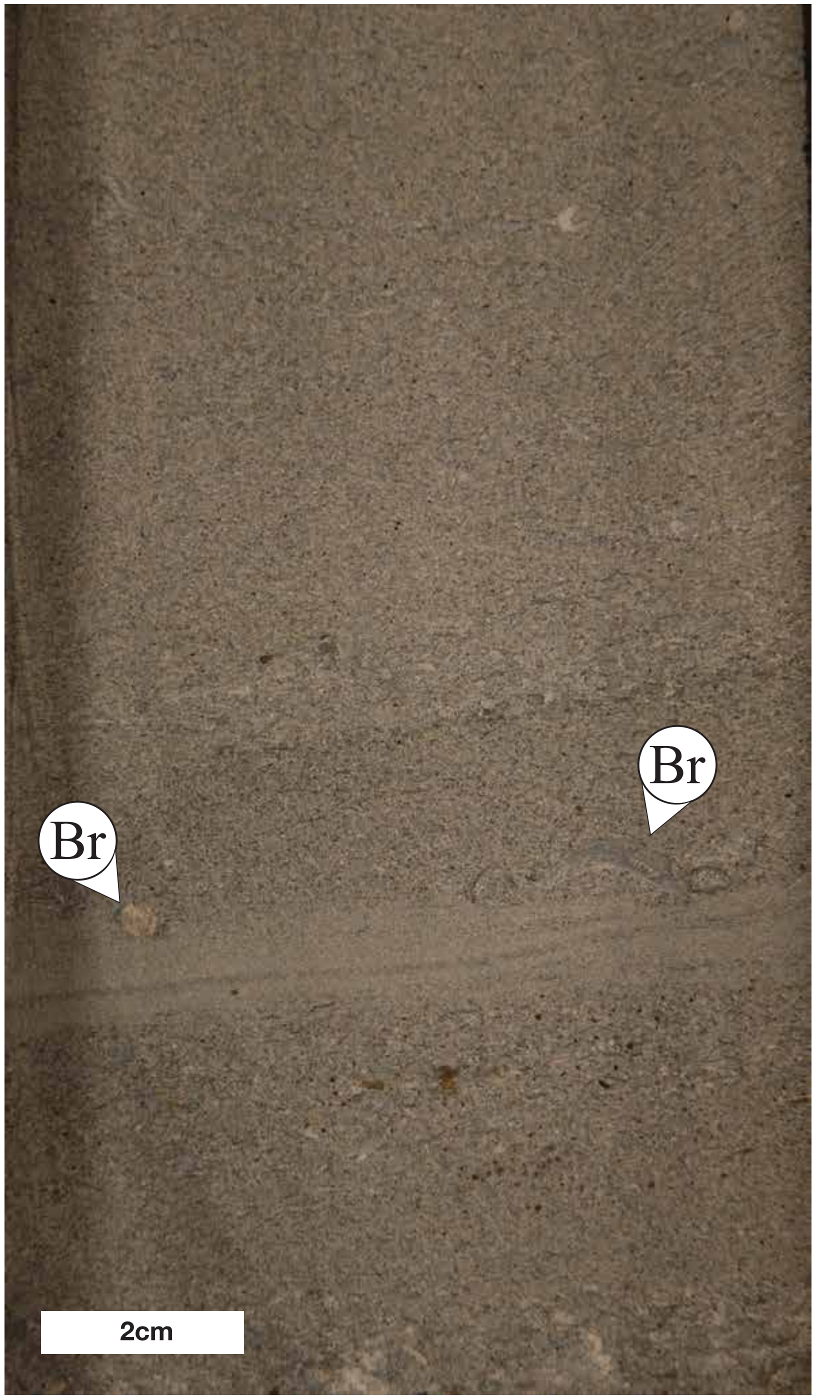

Figure 3.7 – Core photograph of fine-grained F4, where body fossils have been reworked such that they are difficult to identify with the naked eye. Sedimentary structures can be visible, such as the low-angle undulatory laminations seen in the photo above. Rare brachiopod (Br) and crinoid ossicles (Cr) can be identified (Well 05-15-031-26W3 at 818.25 m).

3.6 Facies 5 – Interbedded Mudstone, Siltstone, and Very fine- to Fine-grained Sandstone

3.6.1 Facies 5 Description

Facies 5 is characterized by a heterolithic unit, comprised of very fine- to fine-grained sandstone, siltstone, and mudstone (Figure 3.8). Trace fossils are mostly absent, with an overall bioturbation index of 0-2. Rare, small *Teichichnus rectus* and *Planolites montanus* have been observed. These ichnogenera are difficult to differentiate from the more common soft-sediment deformation structures present in the mud- and silt-rich horizons (Figure 3.9). Sedimentologically, Facies 5 is characterized by wavy-, lenticular, and flaser-bedded sandstone and mudstone. Combined-flow and asymmetrical ripples are also common within the sandstones. Calcite cementation is patchy throughout the study area, though lower parts of Facies 5 commonly appear to be calcite-cemented. Much of the sand content of Facies 5 is moderately to heavily oil stained, which can cause difficulties in describing internal structures.

Facies 5 displays an overall fining-upward trend with silt and mud content increasing moving up in cores. These fining-upward parasequences may stack on top of one another showing multiple cycles of sedimentation.

Facies 5 and Facies 6 do not follow a simple vertical stacking pattern with one facies always present above the other when both are present, but rather are interbedded throughout the study area. This interbedding will be further illustrated later in the thesis.

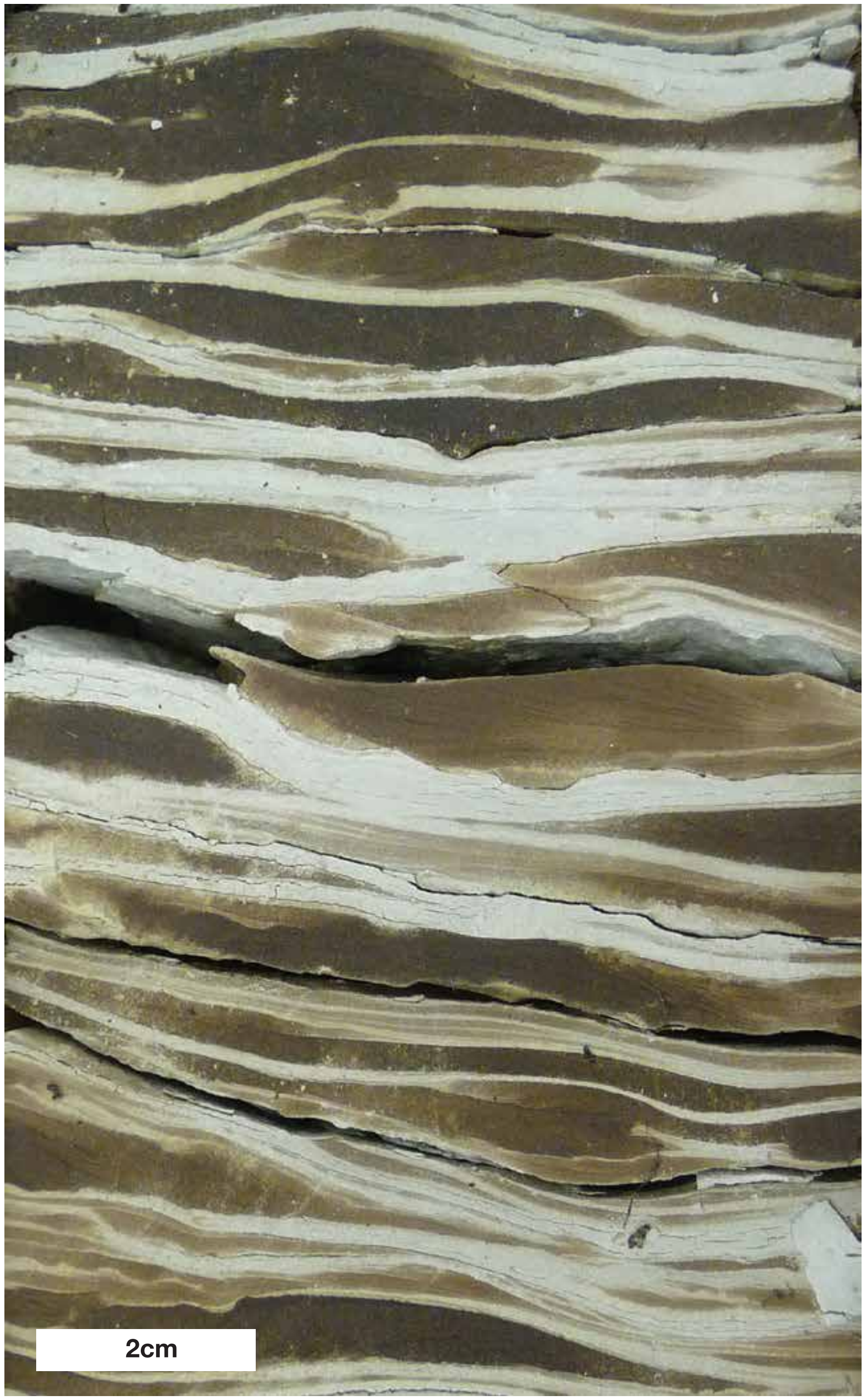

Figure 3.8 – Core photograph of F5 characterized by heterolithic, fine-grained sand and mudstone deposits. Mudstone drapes are common. Thin current laminations are visible within sand lenses (Well 14-31-030-23W3 at 824.00 m).

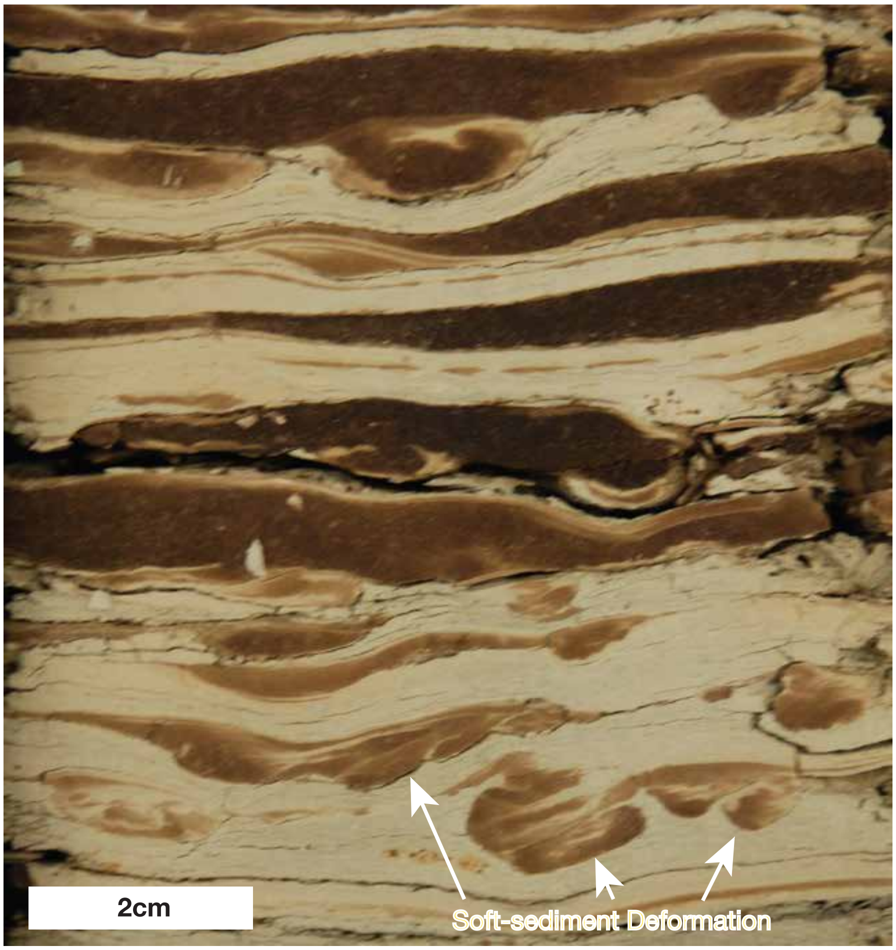

Figure 3.9 – Core photograph of F5 showing common soft-sediment deformation structures that could be mistaken for trace fossils (Well 16-36-030-24W3 at 826.75 m).

3.6.2 Facies 5 Interpretation

The overall heterolithic nature of Facies 5, with its mix of very fine- to fine-grained sandstone, siltstone, and mudstone is evidence of fluctuations in energy within the depositional environment, which is consistent with a tidally-dominated environment where the finest fraction of sediments are deposited during high- and low-tides when tidal currents are rectilinear, and coarser sands are deposited as the tide ebbs and floods periodically, creating an overall unidirectional current regime (Dalrymple, 2010). The asymmetrical and combined-flow ripples within the sandstone horizons are further evidence of a unidirectional current such as would be the case during ebb and flood tides. However, the presence of combined-flow ripples appears to show subordinate wave action.

Although it is possible that the lack of bioturbation is due to high-energy conditions, which would reduce the colonization window for organisms, it may be more reasonable to propose brackish-water conditions. If high-energy conditions were prevalent, there would be a less pronounced heterogeneity to F5. Although bioturbation is known to be of a lower intensity within marine tidal flats, there is generally preservation of trace fossils at bedding interfaces between sands and muds created during low energy periods close to the high- and low-tide limits where suspension fallout is the dominant depositional process (Mángano and Buatois, 2004; Buatois and Mángano, 2011). Bioturbation is for the most part absent in Facies 5 across the study area, which is atypical of fully marine benthic communities. Under fully marine conditions, the presence of a few ichnotaxa consistently across the study area would be expected.

Facies 5 is interpreted as having been deposited in a tidal flat environment, where the overall fining-upward sequence matches that described by Klein (1977) and Dalrymple (2010), where the sandier intervals near the base were deposited close to the low-tide limit and subsequent tidal shift creating a predominantly unidirectional current. The muddier intervals are deposited near the high-tide limit when suspension fallout is the dominant depositional process.

3.7 Facies 6 – Very fine- to Fine-grained Sandstone

3.7.1 Facies 6 Description

Facies 6 is characterized by very fine- to fine-grained, predominantly homogeneous sandstone (Figure 3.10). Sand grains are well sorted, with the majority of the unit heavily saturated with heavy oil, causing difficulties in identifying primary sedimentary structures. Thin (up to 5 cm), white siltstone and mudstone layers occur throughout the unit, but not to the extent that they are observed in the heterolithic Facies 5. Primary sedimentary structures include asymmetrical, symmetrical, and combined flow ripples (Figure 3.11) as well as planar horizontal laminations. Slightly inclined beds that show variable amounts of thin (up to 5 cm) inclined mudstone drapes (Figure 3.12; 3.13; 3.14) have the appearance of inclined heterolithic stratification (IHS). The basal contacts of sandstone packages from Facies 6 can be irregular, appearing erosional. Rip-up clasts are present at the base of some of the sandstone intervals containing silt and mud from underlying packages.

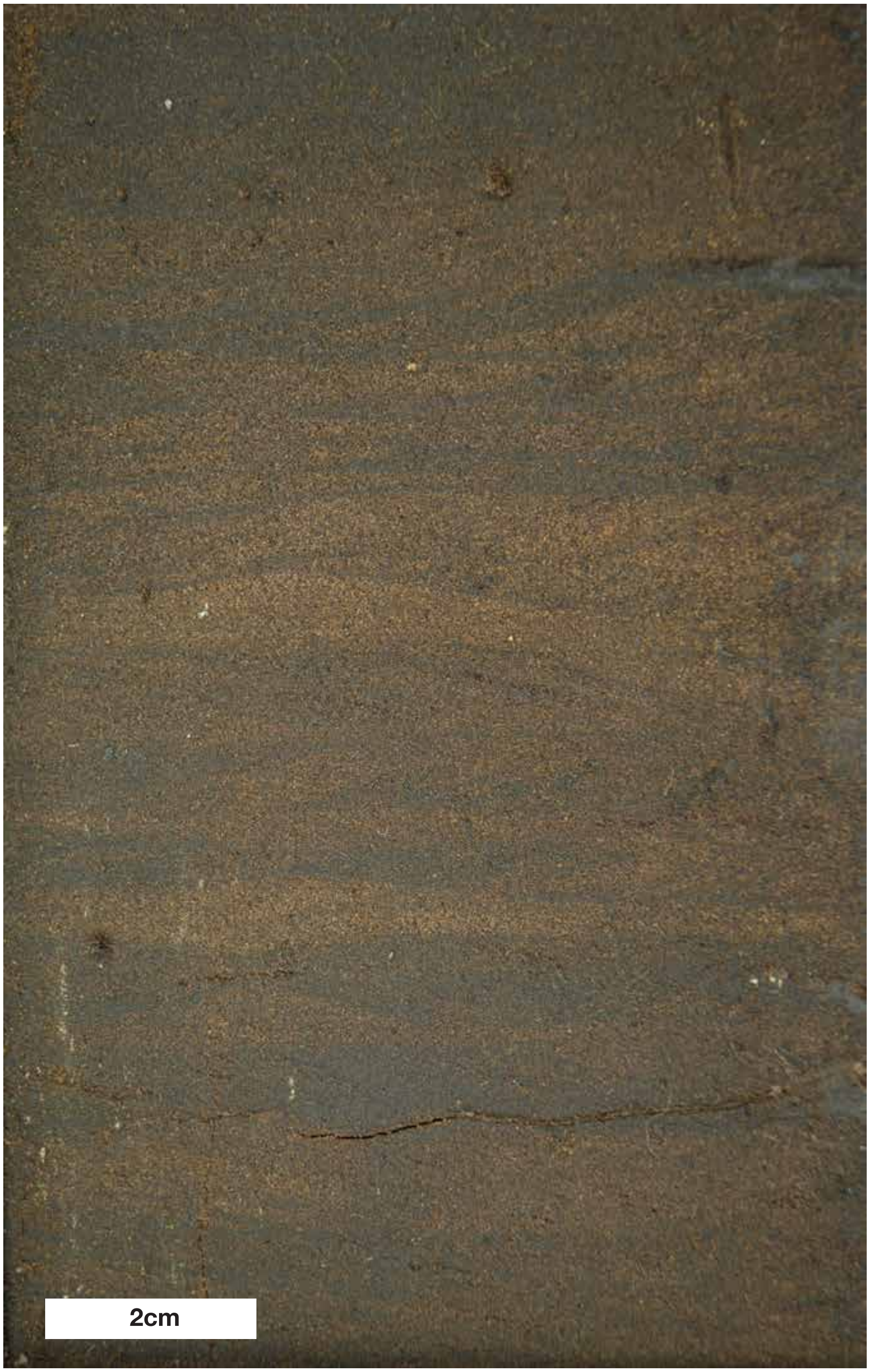

Figure 3.10 – Core photograph of F6 composed of very fine- to fine-grained sandstone. Asymmetrical current ripples are the most commonly observed primary sedimentary structures. Bioturbation is rarely observed (Well 14-07-031-26W3 at 854.40 m).

Figure 3.11 – Core photograph of F6 showing combined-flow ripples that may be indicative of a mixed energy environment where unidirectional and oscillatory energy affected the substrate (Well 03-04-030-28W3 at 824.90 m).

Figure 3.12 – Core photograph of F6 showing slightly inclined laminations that may be indicative of deposition within a channel through lateral accretion (Well 03-18-036-25W3 at 743.50 m).

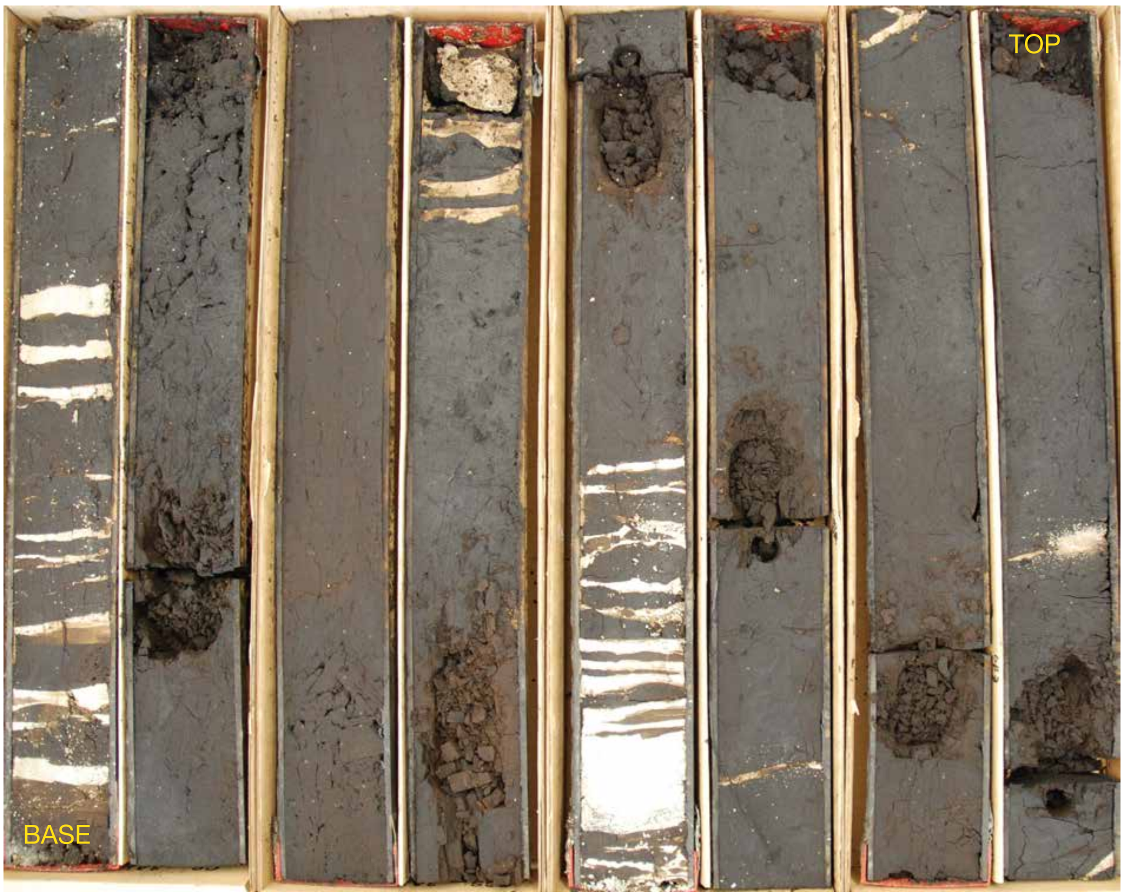

Figure 3.13 – Core photograph showing potential IHS bedding within F6. Note sand-dominated composition (Well 14-31-034-26W3 from 822.50 to 816.50 m).

Figure 3.14 – Core photograph showing potential IHS deposition within F6. This particular section is relatively heterolithic (Well 15-34-030-26W3 from 868.80 to 863.50 m).

Such as with Facies 5, bioturbation is absent in Facies 6. Features present near siltstone/mudstone and sandstone bedding interfaces appear to be soft-sediment deformation structures rather than trace fossils. Unlike Facies 5, where local bioturbation is present, bioturbation has not been observed throughout the study area within Facies 6.

3.7.2 Facies 6 Interpretation

The sand-dominated nature of Facies 6 along with the presence of current ripples and planar horizontal laminations are indicative of relatively high-energy depositional dynamics. The abundance of asymmetrical and combined flow ripples show a strong unidirectional flow component was common. However, the symmetrical and combined flow ripples are also evidence for reworking due to oscillatory forces, perhaps due to localized wave action. The presence of mudstone/siltstone lenses is evidence for lower energy deposition, which coupled with the predominance of unidirectional flow structures, is indicative of deposition in tidal channels (Dalrymple, 2010). The presence of IHS is also evidence of meandering tidal channels, where sand-dominated intervals are deposited through lateral accretion during periods of high discharge as tides ebb and flow through these channels and mudstone drapes are deposited during lower energy times when the channel itself is less active and suspension fallout is the dominant depositional process (Thomas et al., 1987; Hubbard et al., 2011). When these channels are abandoned, lateral accretion reverts back to vertical accretion of clay-size sediments, which is visible in well **(**Figure 3.15**)**.

Figure 3.15 – Core photograph showing an abandoned channel (green box). Upon abandonment, these channels do no show evidence of deposition through lateral accretion but rather vertically, through sediment fallout within the water column (Well 06-21-034-27W3 at 814.90 m).

The lack of bioturbation is partly due to the high-energy processes at work during the deposition of Facies 6. Bioturbation tends to be higher in tidal flats than in tidal channels (Mángano et al., 2002), which is attributed to higher rates of sedimentation within channels. However, the complete lack of bioturbation within both Facies 5 and Facies 6 is evidence for marginal-marine conditions. This combination of high-energy conditions coupled with brackish-water conditions would have made it extremely difficult for a benthic community to establish itself and all traces that may have been formed were most likely not preserved.

The interbedded nature of Facies 5 and Facies 6 may have been the product of tidal channels and tidal flats being deposited autocyclicly across a shallow open coast. The lateral migration of channels can explain the interbedded nature of Facies 5 and Facies 6 with no apparent stacking pattern. Active channel deposition would have eroded the underlying unit, whether it were a heterolithic tidal flat package or a homogeneous channel package from a previous channel. Tidal flats would have been located between channels, where a lack of channelized flow would have allowed for deposition of heterolithic tidal flats (Dalrymple, 2010).

3.8 Facies 7 – Bioturbated Siltstone/Sandstone

3.8.1 Facies 7 Description

Facies 7 is characterized by siltstone to very fine-grained sandstone that has been heavily reworked by biogenic activity (Figure 3.16). Although reworking of the primary sedimentary fabric is high (BI of 4-5), ichnodiversity is overall low, with *Planolites montanus* and *Teichichnus rectus* present as the dominant ichnotaxa with subordinate *Rosselia socialis* and *Asterosoma* isp. Despite the intense bioturbation, a faint horizontal fabric is distinguishable. Oil staining causes problems with the identification of ichnofossils due to their internal makeup being masked.

3.8.2 Facies 7 Interpretation

Facies 7 is being interpreted as having been deposited under similar conditions to those in Facies 5, based on the presence of a faint horizontal fabric similar to that seen in Facies 5. However, conditions allowed for colonization and subsequent reworking of the unit. Facies 7 may be a more marine expression of Facies 5 where marginal-marine conditions were not as pronounced and marine conditions were better established. A distinct depositional environment is difficult to assign due to the nearly complete reworking of the primary sedimentary fabric.

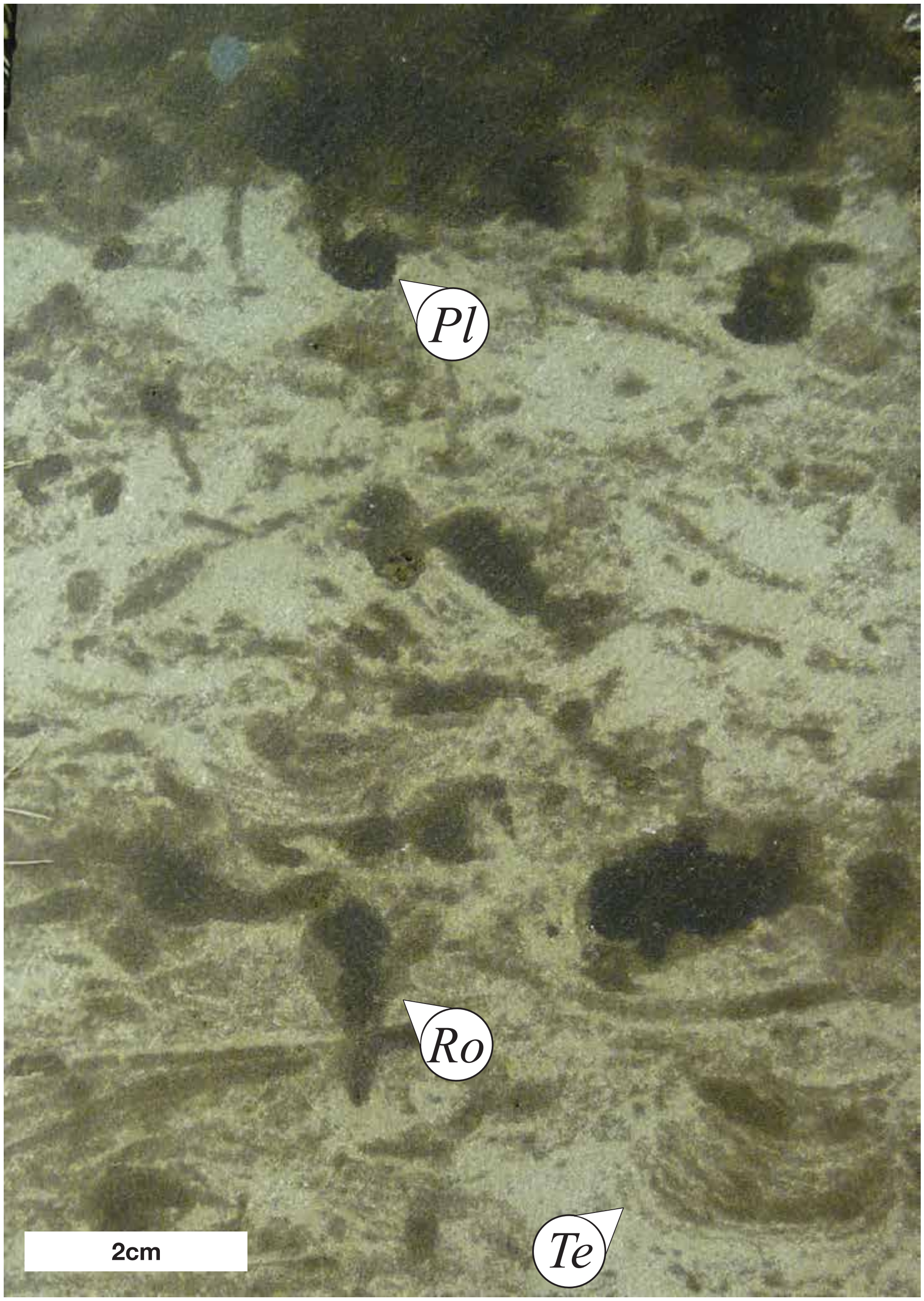

Figure 3.16 – Core photograph of F7, showing the heavily bioturbated tidal deposits characterized by *Teichichnus rectus* (*Te*), *Rosselia, socialis* (*Ro*), and *Planolites montanus* (*Pl*). Oil staining can cause problems in identifying discrete ichnotaxa due to the masking of internal structures (Well 14-31-030-23W3 at 818.70 m).

3.9 Facies 8 – Massive and Brecciated Silstone

3.9.1 Facies 8 Description

Facies 8 (Figure 3.17) ranges in color from white to pale brown. Facies 8 varies from relatively homogeneous to heterolithic in nature, however is predominantly composed of siltstone. It is characterized by an overall massive texture, with some portions showing a slightly brecciated texture. Facies 8 can also display a faint horizontal to subhorizontal laminated texture, which is most likely the relict texture from the underlying unit that has undergone slight pedogenesis. Root trace fossils have been tentatively identified. The best examples of root traces have been lightly oil stained. These oil-stained roots appear to have branched off of a main taproot, which have been described as having developed as far back as the Late Devonian (Retallack, 1997). Although Facies 8 is rarely observed, it tends to occur in association with Facies 5 and/or Facies 6, generally within interbedded packages of F5/F6.

3.9.2 Facies 8 Interpretation

Facies 8 is being interpreted as having been deposited in association with F5/F6 as immature waterlogged paleosols that underwent slight pedogenesis. The relict horizontal to subhorizontal fabric is evidence for waterlogged paleosols that developed incipient soil processes, but not to the point where the pre-existing sedimentary fabric can be obliterated (Retallack, 2001). The presence of these paleosols is consistent with the stratigraphic context established by the other facies already described. The massive, homogeneous paleosols occur sandwiched between mud flat deposits, which are evidence for deposition in a supratidal-like setting where preliminary pedogenesis may have occurred. The heterogeneous paleosols, which commonly have relict sedimentary fabrics, are described within large packages of IHS from

Facies 6. These paleosols may have been formed in areas where channels were abandoned, yet subsequently flooded such that the paleosol could not become fully established.

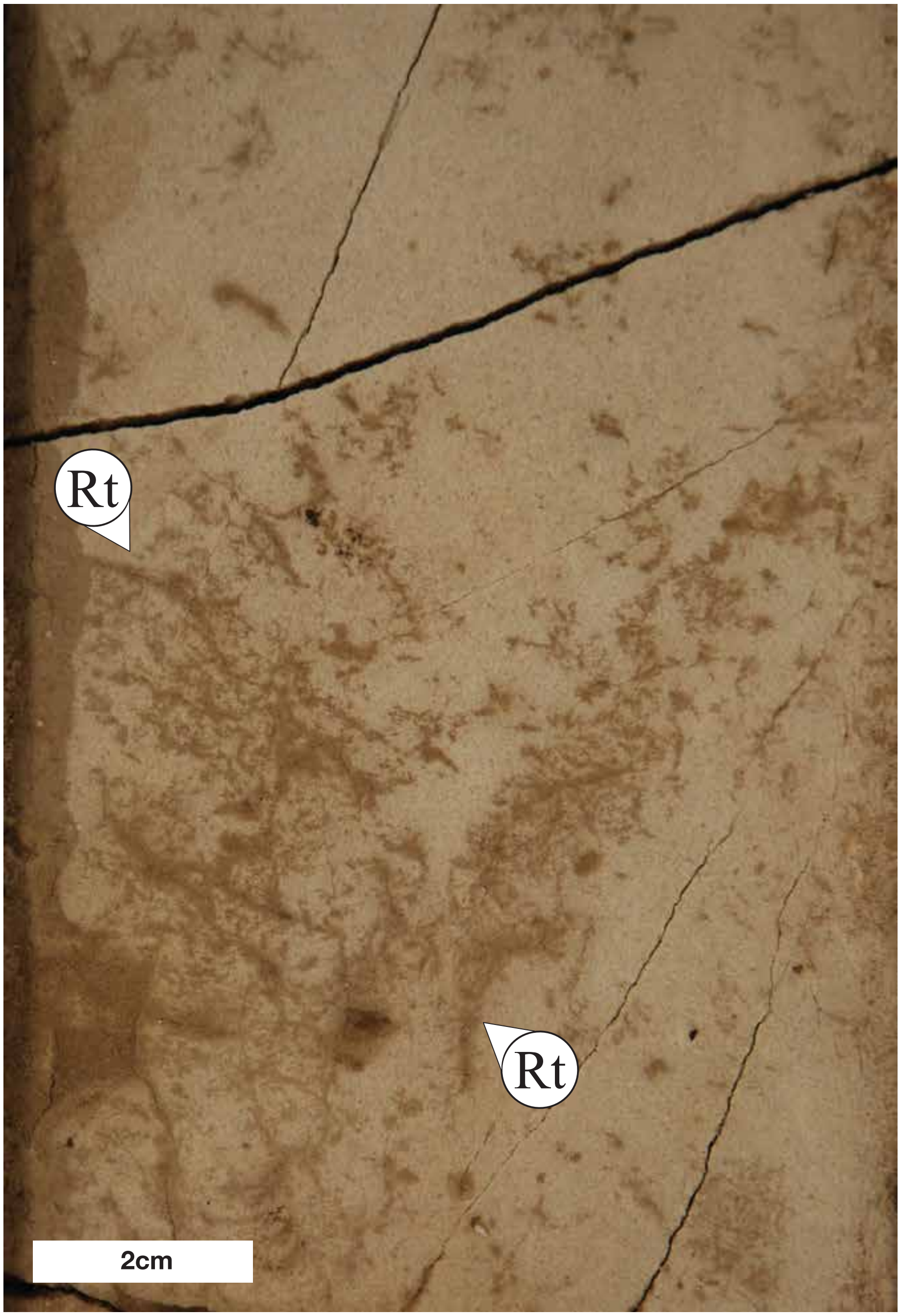

Figure 3.17 – Core photograph of F8, characterized by potential root traces (Rt) that may have formed in waterlogged, immature paleosols (Well 03-27-033-28W3 at 882.30 m).

3.10 Facies Associations

3.10.1 Introduction

There are two facies associations defined in the Bakken Formation of west-central Saskatchewan, with the primary criteria for grouping being whether deposition occurred under open-marine conditions or marginal-marine conditions (Figure 3.18).

Although environmental conditions were the primary criteria for grouping, within the facies associations themselves some of the facies do show intrinsic links in terms of depositional environments, most notably within the marginal-marine interval of Facies Association 2.

3.10.2 Facies Association 1: Open Marine Interval

Facies Association 1 (FA1) is comprised of F1, F2, F3, and F4 (Figure 3.19). FA1 occurs at the base as well as the top of the Bakken Formation in west-central Saskatchewan. However, F1 (Lower Black Shale Member) in FA1 at the base of the Bakken is overlain by either F2 and F3 or F4 depending on the location within the study area, whereas FA1 at the top of the Bakken is composed solely of F2 overlain by F1 (Upper Black Shale Member). All facies within FA1 are interpreted as having been deposited in an open-marine, wave-influenced environment.

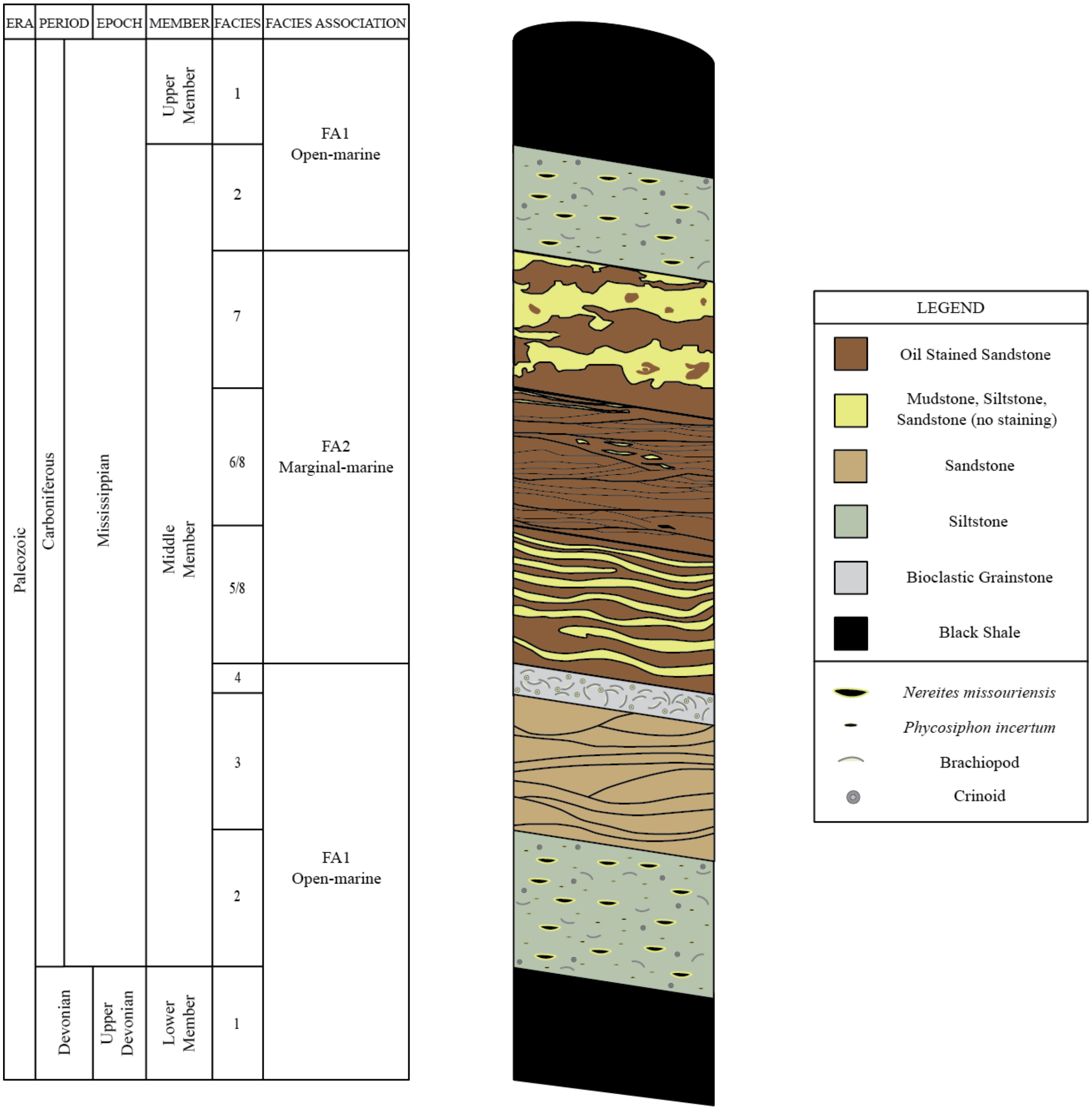

Figure 3.18 – Idealized stratigraphic column of the Bakken Formation from west-central Saskatchewan with the breakdown of FA1 (open-marine) and FA2 (marginal-marine).

Figure 3.19 – Complete sequence showing FA1 (lower) and FA1 (upper), with the Upper Black Shale Member capping the sequence (Well 10-03-030-29W3).

F2, which is subdivided into Sf 2A and 2B, was deposited between storm-weather wave base and fair-weather wave base. The finer-grained Sf2A, which is predominantly siltstone and heavily bioturbated, was deposited in a lower offshore environment closer to the storm-weather wave base, where the predominant depositional process was suspension fallout, allowing for horizontal grazing organisms to heavily rework the substrate. Sf2B has a higher sand content relative to Sf2A and was most likely deposited in the upper offshore to offshore transition, where coarser-grained sediments were introduced to the system through storm activity more often due to its proximity to the fair-weather wave base.

The ichnoassemblage also changes from Sf2A to Sf2b, with *Phycosiphon incertum* and *Nereites missouriensis* being the dominant ichnotaxa in Sf2A transitioning into Sf2B, which is dominated by *Nereites missouriensis* and subordinate *Asterosoma* isp. These changes in trace-fossil content show subtle changes in environmental parameters within F2.

F3 was deposited in a lower to middle shoreface setting. Although lower to middle shoreface environments tend to show thick successions of amalgamated hummocky cross-stratification (HCS) along with wave-ripples, the relatively shallow setting and overall low-energy conditions of the Bakken Formation (Angulo and Buatois, 2011) may be the reason why wave-ripples are ubiquitous instead.

F4, despite being predominantly made up of carbonate, has been grouped within FA1 due to deposition being interpreted as having been contemporaneous with F2 and F3 within the same open-marine system. The presence of F4 is primarily restricted to the southeastern part of the study area.

3.10.3 Facies Association 2: Marginal-marine Interval

Facies Association 2 (FA2) is comprised of F5, F6, F7, and F8. It is interpreted as having been deposited in a marginal-marine, tide-dominated setting across a shallow embayment.

F5 and F6, when present, occur in the basal portion of FA2, directly above FA1. The interbedded nature of F5 and F6 are interpreted as having been deposited as a succession of tidal flats and tidal channels/bars that migrated laterally across the study area. F5 and F6 do not show a straightforward stacking pattern, with either facies at times being observed above the other (Figure 3.20). Modern tidal flats, whether sand-dominated or mud-dominated tend to have complex channel networks dissecting them (Hughes, 2012). These channel networks migrate laterally across large areas. In sand-dominated tidal flats, channel networks tend to coalesce and form wider channels, whereas in mud-dominated tidal flats channels tend to be smaller in size.

F8 has been interpreted as paleosols, particularly immature, waterlogged paleosols that did not undergo full pedogenesis. Abandoned channels tidal flat/tidal channel areas that may have subsequently been flooded could account for these immature paleosols, which are rarely preserved.

F7 is being interpreted as a more marine expression of F5. The heavy biogenic reworking of the sedimentary fabric causes problems in assigning a distinct depositional environment, but the faint horizontal fabric appears similar to that found in F5.

Figure 3.20 – Core photograph showing the marginal-marine interval (FA2), showing the interbedding of F5/F6 overlain by the heavily bioturbated F8. FA2 is overlain by FA1 (upper), which is subsequently overlain by the Upper Black Shale Member (Well 14-31-030-23W3).

CHAPTER 4

4. STRATIGRAPHIC ARCHITECTURE

4.1 Introduction

The previous chapter described the facies present throughout the Bakken of west-central Saskatchewan. These facies were then grouped into facies associations based on common characteristics, illustrating that they were deposited either while open-marine or marginal-marine conditions prevailed in the study area. This chapter will illustrate the distribution of these facies associations throughout the study area.

Eight geological isopach maps along with two structural surface maps were created to elucidate the spatial trends of the Bakken Formation. Although it is common to build geological cross-sections to aid in providing a depositional framework in stratigraphic studies, a large portion of the Bakken Formation in west-central Saskatchewan has been reworked by multiple periods of post-Mississippian erosion. Sedimentary architecture has been affected by post-Bakken erosion and, therefore, using stratigraphic cross-sections to elucidate depositional history may be misleading. Post-Mississippian erosion may also have removed key packages that would have completed the depositional history of the area. Instead of building stratigraphic cross-sections of the Bakken Formation, an isopach map of the overlying Mississippian carbonates as well as a structural surface map of the sub-Mesozoic unconformity will be used to illustrate how much of the Bakken has potentially been reworked through post-Bakken erosion, in turn showing areas of uncertainty when it comes to reconstruction of the depositional history of the Bakken Formation.

4.2 Geophysical Well-log Signatures

Consistent well-log signatures were identified (Figure 4.1; 4.2) in order to create the geological maps within this chapter. This was achieved by comparing well-logs with the cores logged to delineate consistent geophysical trends throughout the Bakken Formation.

The black shales of F1 have a distinct geophysical well-log signature characterised by elevated gamma-ray values that are commonly greater than 200 GAPI, accompanied by a sharp shift of the neutron-density well-log signature towards the left.

F2/F3 are grouped together as they are gradational when present making it difficult to delineate a definite surface between the two. F2 is characterised by low density porosity values from 3-12% coupled with elevated gamma-ray values ranging from 75-105 API. The separation between the neutron and density signatures is normally around 7 grid squares. As F2 grades into F3 the density porosity values increase, with values reading up to 24%. As these density porosity values increase the gamma-ray values tend to decrease towards an average of 60 API. The separation between the neutron and density signature also decreases from 7 grid squares to between 2 and 3. At times there is a somewhat abrupt drop in the gamma-ray signature between F2 and F3, however this is not consistent throughout the study area.

F4 has a similar signature to that of F2, with low density porosity values ranging from 0 to 3%. Due to the higher carbonate content in F4, the density porosity curve can read negative if the density porosity tool has been calibrated to a sandstone matrix, which is not the case for F2. Although the density porosity values are similar between F2 and F4, the gamma-ray values are much different. F4 is characterised by overall low gamma-ray values, often reading between 15-45 API.

Although it is possible to identify individual facies within FA2, the lack of a consistent stacking pattern led to the identification of FA2 on well-logs instead of its individual facies. Due to its overall heterolithic composition, F5 commonly displays a serrated gamma-ray signature, with clay-rich horizons showing elevated API readings and sand-rich horizons showing lower gamma-ray signatures. Due to the heterogeneity of F5, the density porosity values are variable as well, with sand-rich horizons reading between 25-35%. F6 displays a more consistent signature trend than F5 due to an increase in homogeneity. Gamma-ray signatures tend to range between 15 and 60 API coupled with density porosity values greater than 27%.

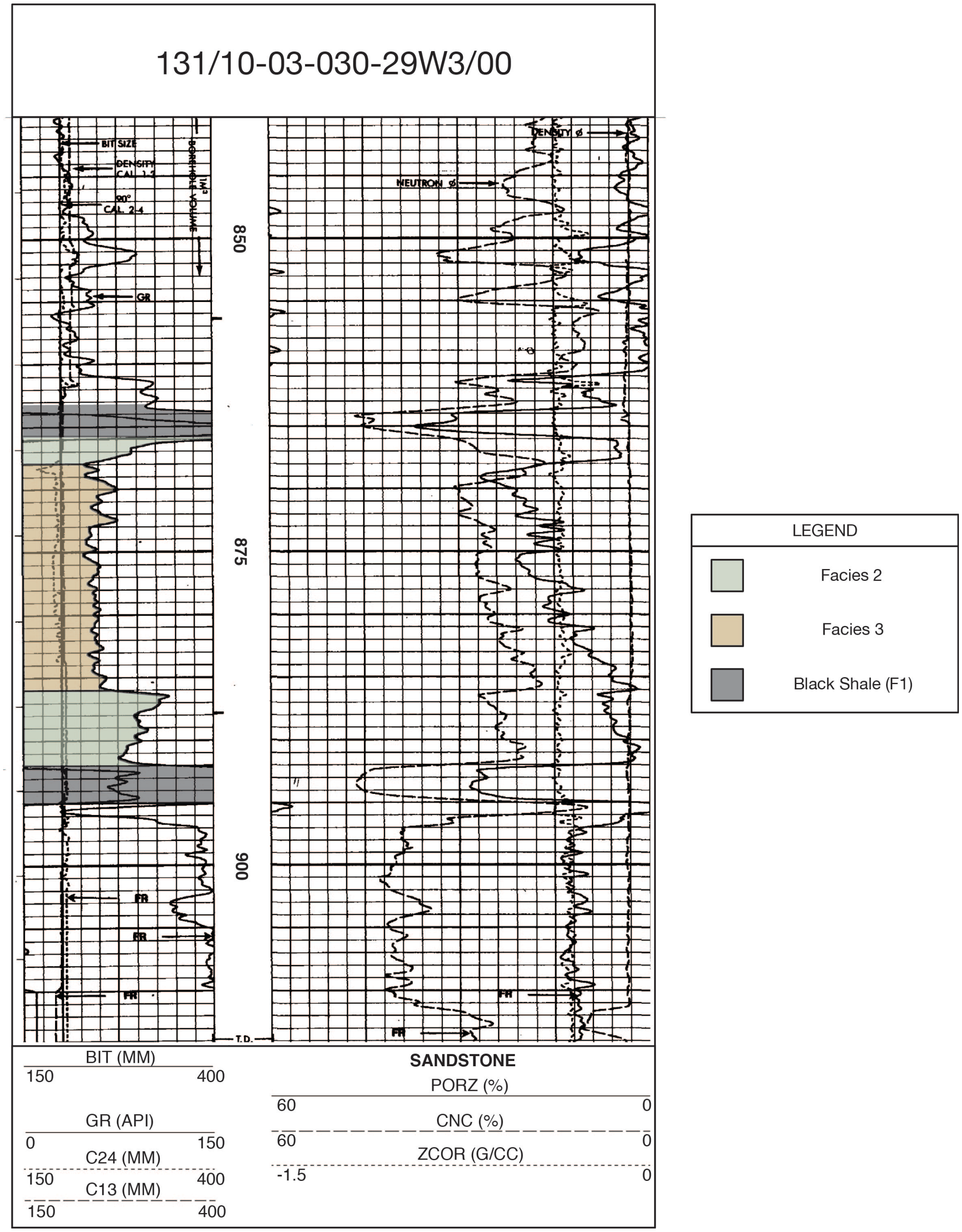

Figure 4.1 – Geophysical well-log from the Bakken Formation, west-central Saskatchewan showing the geophysical log signatures and corresponding facies used to identify facies and facies associations throughout the study area.

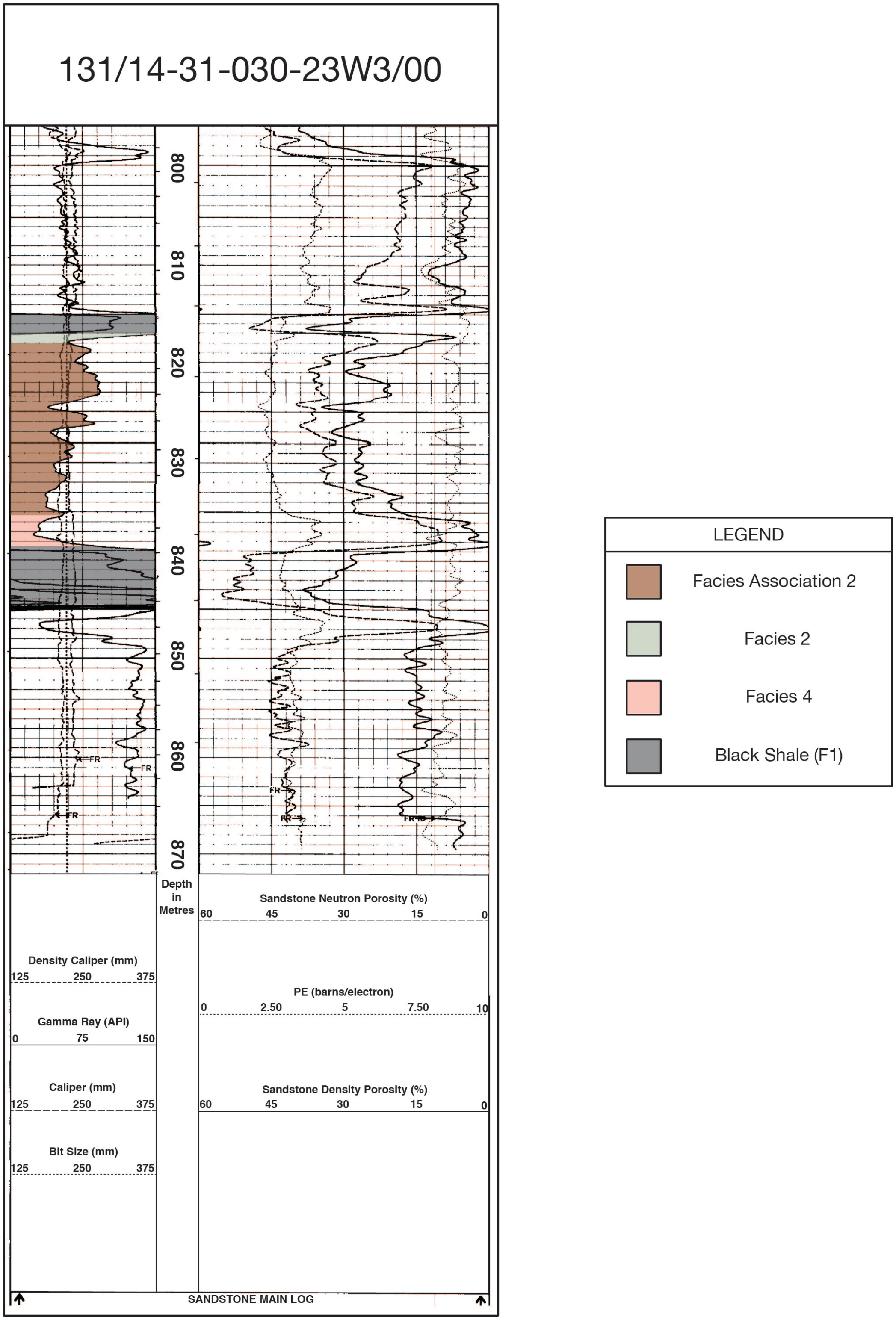

Figure 4.2 – Geophysical well-log from the Bakken Formation, west-central Saskatchewan showing geophysical log signatures used to identify facies and facies associations throughout the study area.

4.3 Isopach and Structural Surface Maps

Geological isopach and structural surface maps were created using tops picked in drill core as well as geophysical well logs. The structural surface maps include the top of the Big Valley Formation, which the Bakken Formation unconformably overlies, as well as the sub-Mesozoic erosional surface, which illustrates the complex erosional history that has affected the Bakken Formation post-deposition. Isopach maps include the Lower and Upper Black Shale Members, F2/F3, F4, FA2, and the Mississippian carbonates that conformably overlie the Bakken Formation. Tops for the Big Valley and sub-Mesozoic structure maps as well as the Lower/Upper Black Shale Members and Mississippian carbonate isopach maps were taken from Marsh and Love (2014). All of the geological maps in this study were created with the goal of building a depositional model through thickness trends, but also to see how post-Mississippian erosion has affected the study area and whether this limits the scope of the depositional model.

4.3.1 Big Valley Structure Surface Map

The structure surface map of the Big Valley Formation (Figure 4.3) was created to see whether or not the spatial trends described in the overlying Bakken Formation could be linked to the underlying structural surface. Mapping of the Big Valley Formation revealed a general North/South to Northeast/Southwest deepening trend that appears to loosely correlate with the distribution of the overlying Bakken Formation. Paleohigh areas of the Big Valley structural surface occur from township 36 and progressively deepen towards the paleolows seen throughout township 30 in the south, although an anomalous low appears through township 31 and 32 along range 23W3.

4.3.2 Lower Black Shale Member Isopach Map

The isopach map of the Lower Black Shale Member (F1) shows a fairly consistent distribution throughout the study area, with the zero edge trending northwest to southeast from township 36, range 25W3 through to township 33, range 20W3 (Figure 4.4). The Lower Black Shale Member ranges in thickness from 1 m throughout the majority of the study area to 13 m in the far eastern part of area. The well control in the southwestern part of the study area, where the Lower Black Shale Member is thickest, is much lower than in the rest of the area making it difficult to ascertain whether or not the distribution is accurate or not.

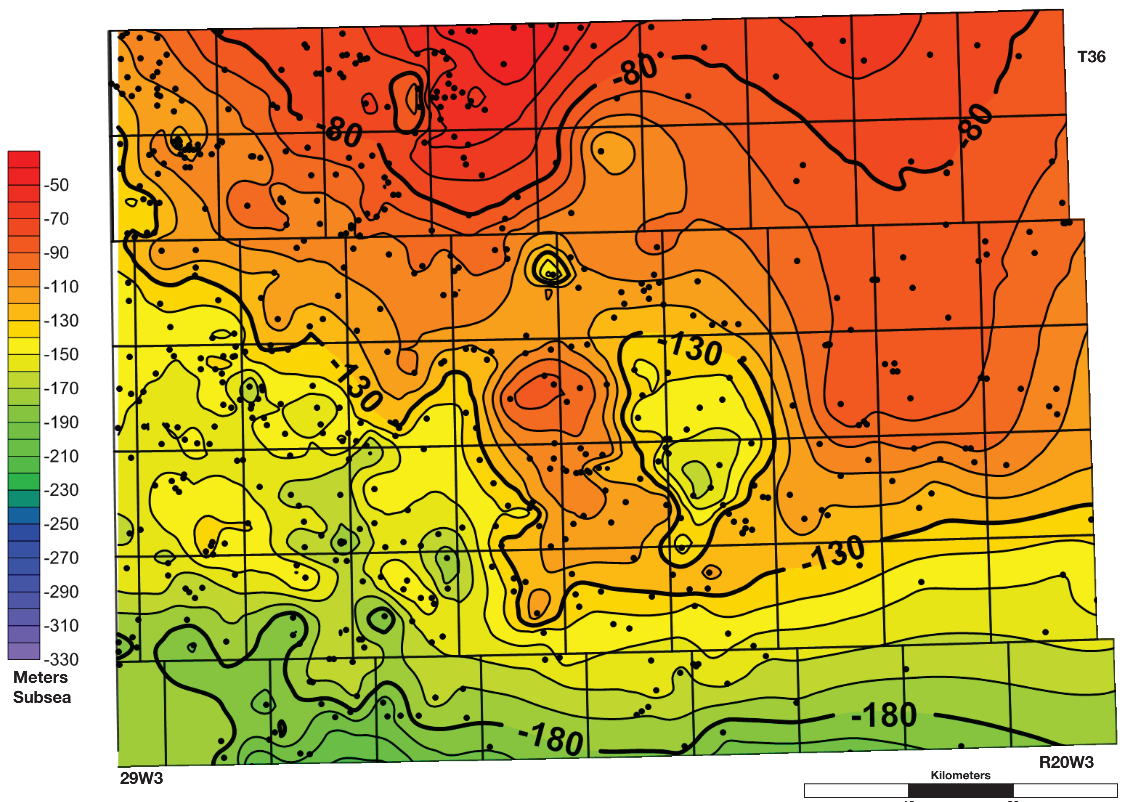

Figure 4.3 – Structure surface map of the Big Valley Formation showing a general north-south/northeast-southwest deepening trend.

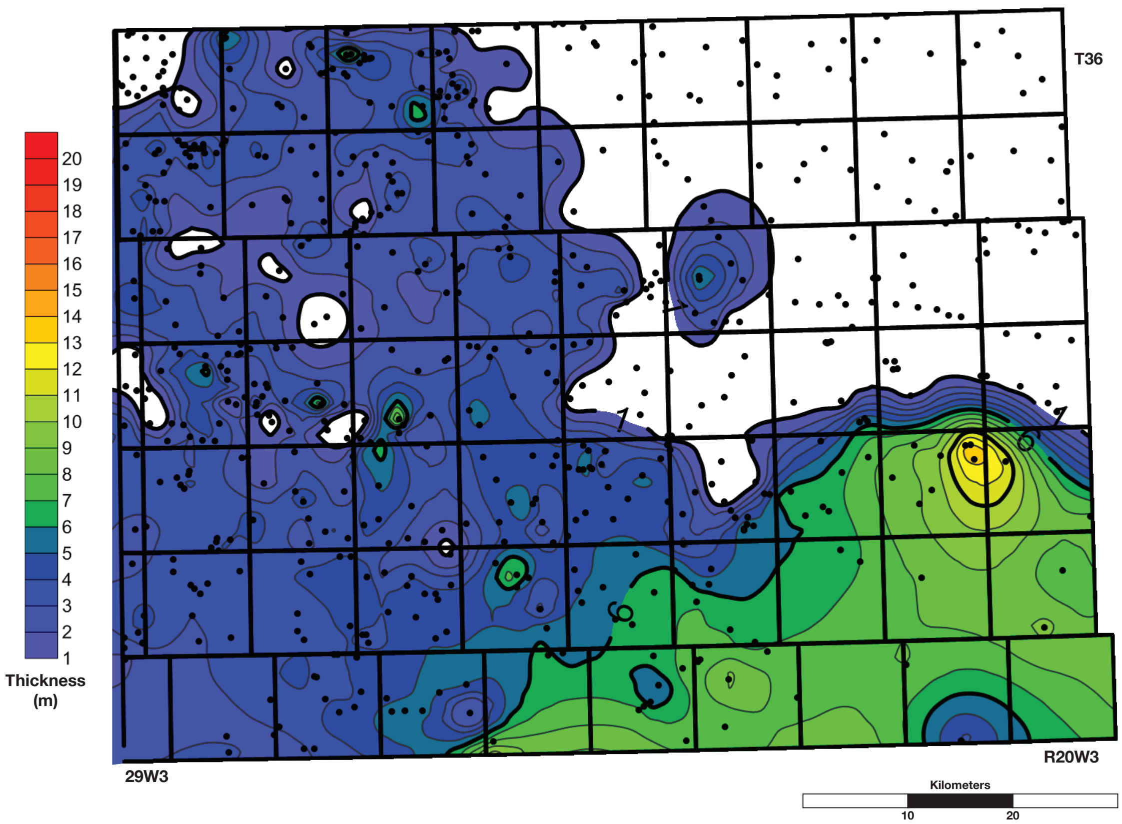

Figure 4.4 – Isopach map of F1 (Lower Black Shale Member).

4.3.3 Facies 2/Facies 3 Isopach Map

The isopach map of F2/F3 (Figure 4.5) appears to mirror the overall structural trend of the underlying Big Valley Formation structural surface, with the thickest accumulations occurring in the southwestern part of the study area throughout townships 30 and 31, with thicknesses up to 21 m in township 30, range 29W3. The distribution of FA1 gradually thins towards the northeast, with distribution becoming increasingly patchy.

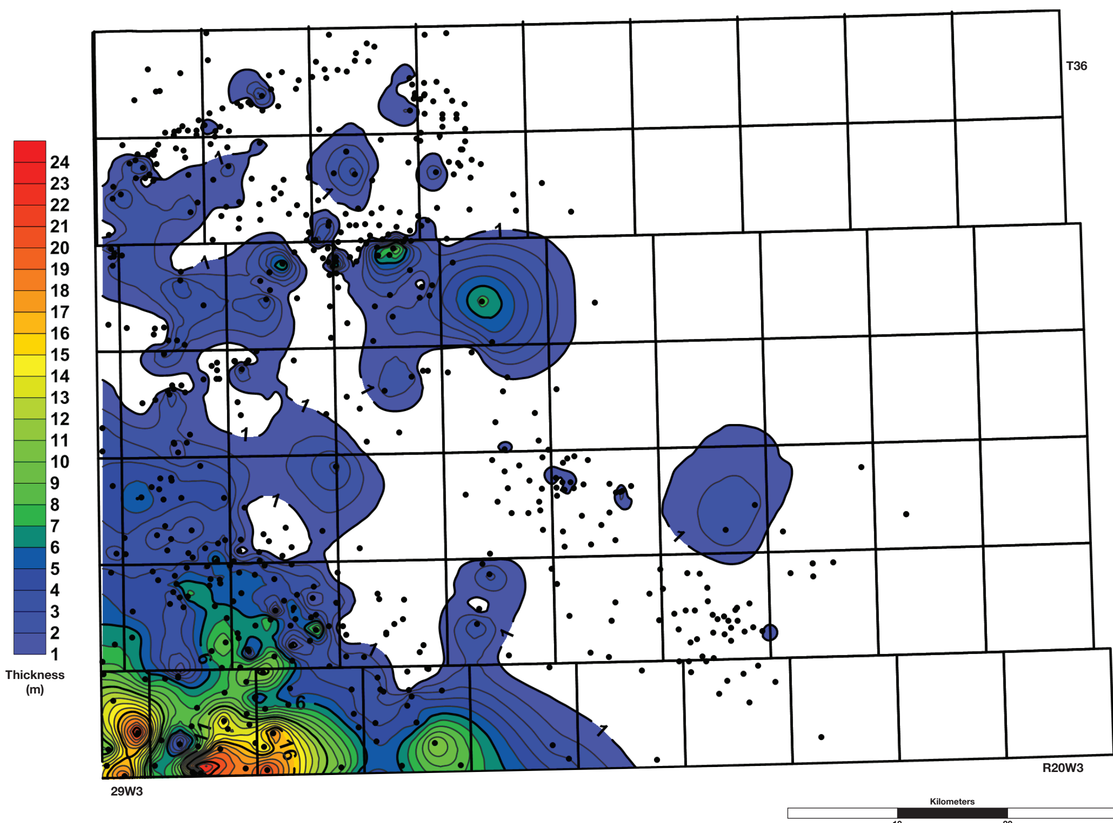

Figure 4.5 – Isopach map of F2/F3, showing distribution primarily restricted in the southwestern part of the study area.

4.3.4 Facies 4 Isopach Map

The isopach map of F4 (Figure 4.6) shows restriction to the southeastern part of the study area. Similar to F2/F3, this aligns with the deeper part on the Big Valley structure surface map. Outside of the southeastern corner, distribution is extremely patchy, with F4 mostly being absent.

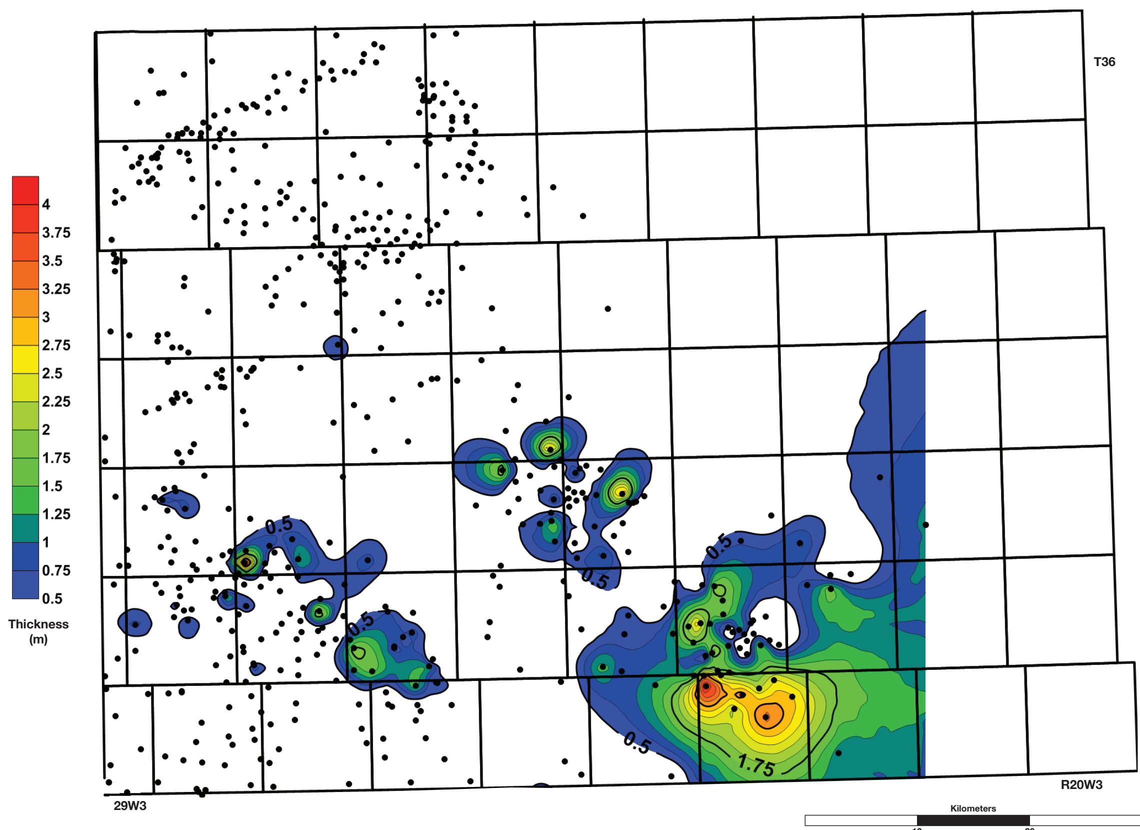

Figure 4.6 – Isopach map of F4 showing distribution primarily restricted to the southeastern part of the study area.

4.3.5 Facies Association 2 Isopach Map

The isopach map of FA2 (Figure 4.7), the middle marginal-marine interval, does not show a consistent distribution trend throughout the study area. Townships 30 and 31 show variable thicknesses ranging from 1 to 22 m. Many of the thickest areas consistently show intervening areas where FA2 is thinner (1-11 m).

The northern part of the study area, from townships 34 to 36, ranges 26W3 to 29W3 shows a similar trend to that of the southern part of the study area with regards to FA2, although the intervening thins are more pronounced. FA2 ranges from 1 to 23 m in this part of the study area. There appears to be a northeast to southwest linear trend to FA2 in the north part of the study area.

Between townships 31 and 33, FA2 is much thinner overall than in the southern and northern sectors, with the majority of the area showing thicknesses between 1 and 11 m. The overall well distribution throughout this section is much lower than in the northern and southern parts of the study area.

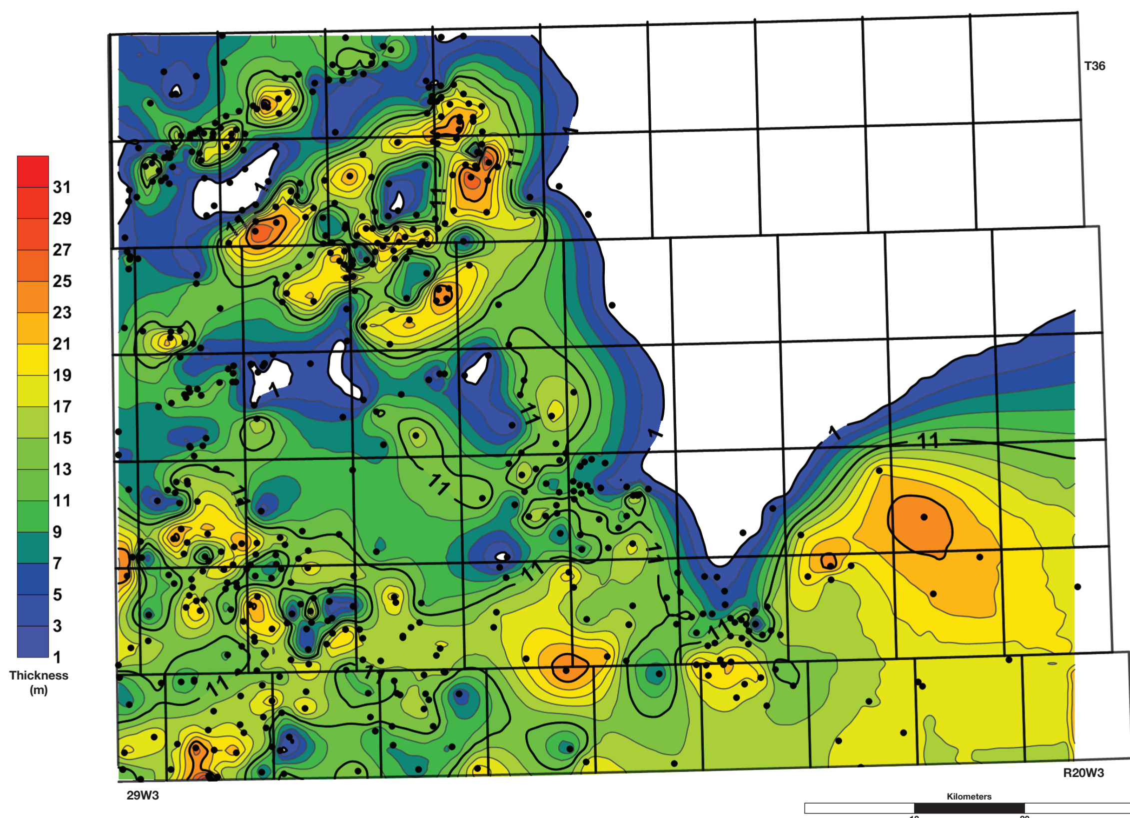

Figure 4.7 – Isopach map of FA2 (F5/F6/F7/F8) showing distribution across the study area, with the southern and northern parts of the study area showing thick and thin morphologies. FA2 in the central part of the study area is noticeably thinner than other parts of the study area.

4.3.6 Facies 2 (Upper) Isopach Map

F2 (upper), which corresponds to the lower part of FA1 (upper), shows a similar distribution to F2 (lower) in that it is mostly located throughout the southern part of the study area (Figure 4.8). However, the overall thickness of F2 (upper) is far lower than what is illustrated by the isopach map of F2/F3 (lower). F2 (upper) rarely reaches more than 1 m in thickness and is more often than not missing completely.

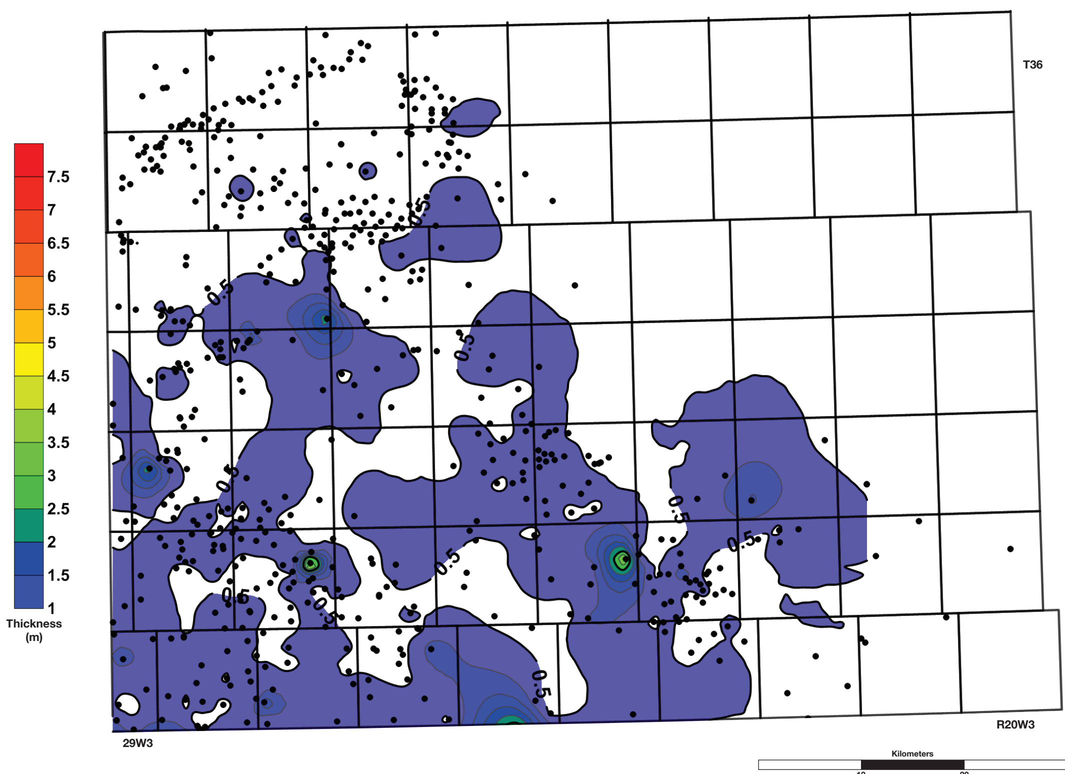

Figure 4.8 – Isopach map of F2 (upper), showing an overall thin profile with patchy distribution.

4.3.7 Upper Black Shale Member Isopach Map

The Upper Black Shale Member is far less continuous in its distribution compared to that of the Lower Black Shale Member (Figure 4.9). Although the average thickness is higher when it is present, there is a large portion of the study area from township 36 through township 32 where the Upper Black Shale Member is not present.

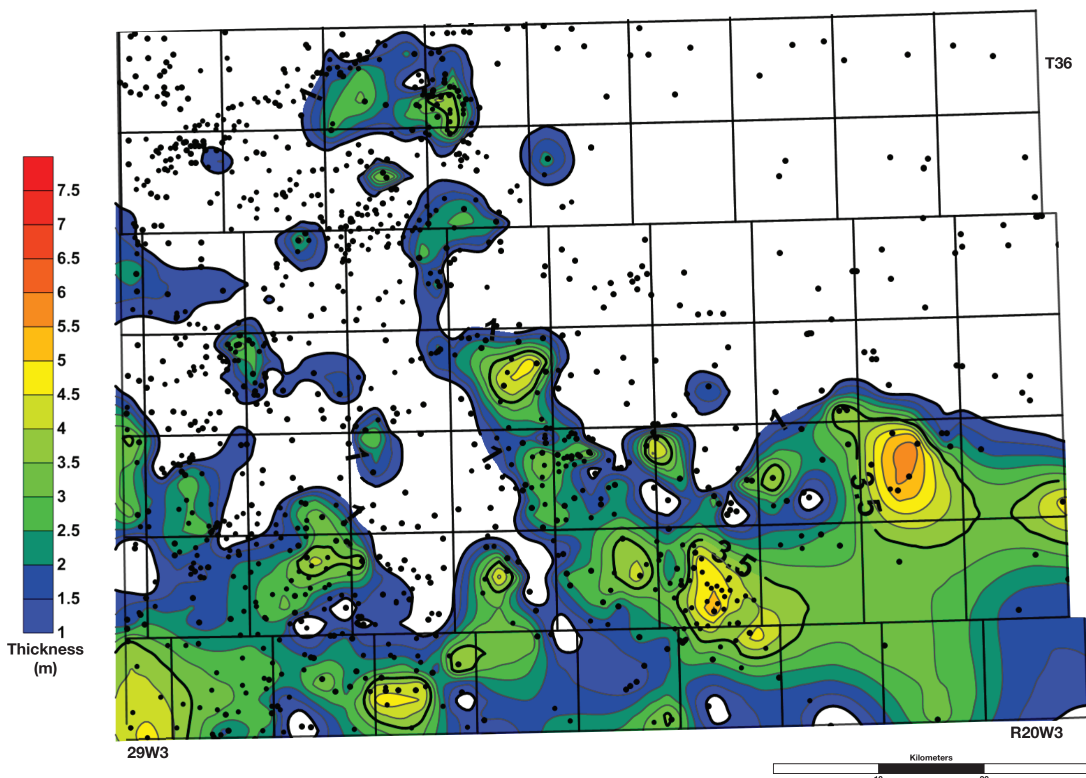

Figure 4.9 – Isopach map of F1 (Upper Black Shale Member) illustrating a less consistent distribution compared to the Lower Black Shale Member, with a large area from T36 to T31 showing little to no distribution.

4.3.8 Mississippian Carbonates Isopach Map

The isopach map of the Mississipian carbonates (Figure 4.10), which in west-central Saskatchewan corresponds to the Madison Group, shows a north-south thickening trend, with much of the carbonates either missing or approximately 1 m thick. In the furthest southwestern part of the study area, the Madison Group is much thicker with thicknesses greater than 26 m in township 30, range 27W3. However, these strata show poor lateral continuity throughout the study area.

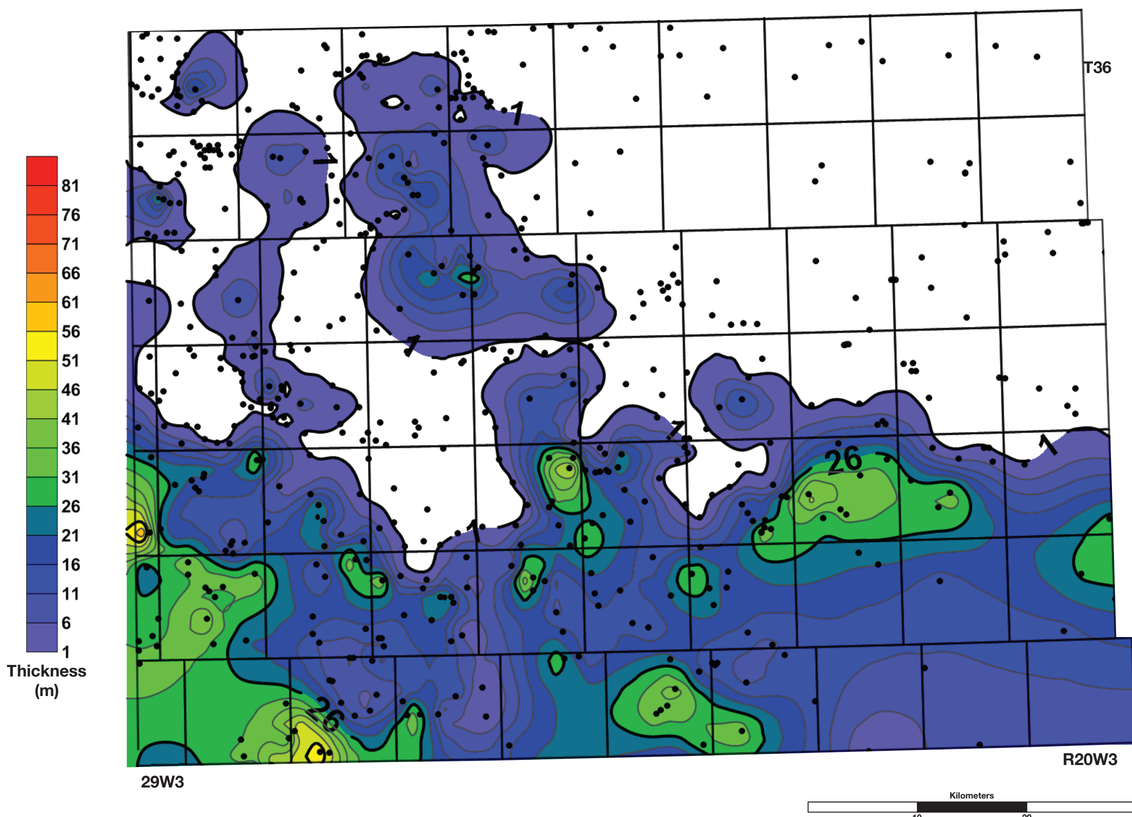

Figure 4.10 – Isopach map of the Mississippian carbonates that overlie the Bakken Formation showing a similar distribution to that of the underlying Upper Black Shale Member.

4.3.9 Sub-Mesozoic Unconformity Structural Surface Map

The sub-Mesozoic unconformity coincides with either the base of the Jura-Cretaceous Success Formation or the base of the Lower Cretaceous Mannville Group where the Success Formation is not present. The overall trend is similar to that of the Big Valley structural surface map, with an overall north-south deepening trend. However, the northeast-southwest deepening trend is more pronounced than in the Big Valley structure surface map (Figure 4.11). The anomalous low described from the Big Valley structure surface map around townships 31 and 32, range 23W3 is also present.

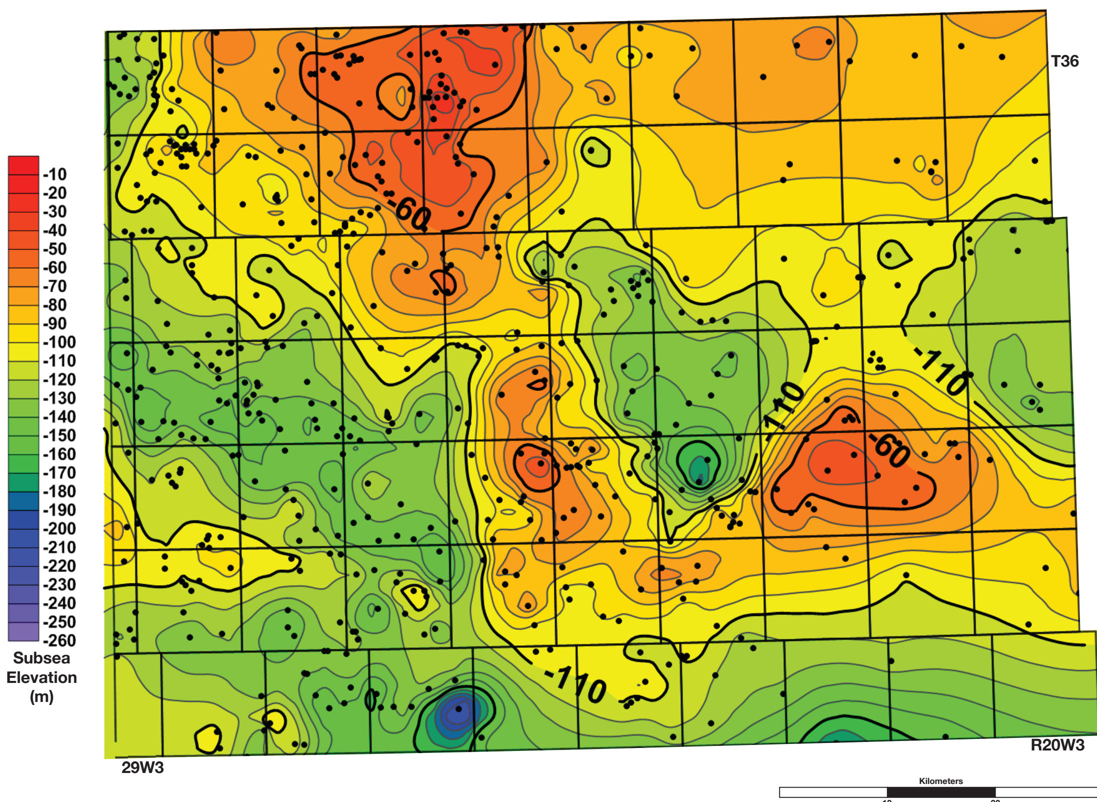

Figure 4.11 – Structure surface map of the Sub-Mesozoic unconformity showing similar trends to those seen on the Big Valley structure surface map. The Sub-Mesozoic unconformity coincides with the base of the Success Formation or, more commonly, the base of the Lower Cretaceous Mannville Group.

4.4 Effects of post-Mississippian Erosion on the Distribution of the Bakken Formation in west-central Saskatchewan

The Bakken Formation of west-central Saskatchewan has undergone multiple periods of post-depositional erosion, which appear to have affected the overall distribution of the Bakken throughout the study area. These periods of incision and erosion cause problems when attempting to create a depositional model due to the potential removal of sedimentary packages that could link the facies associations previously described.

The solution to illustrate areas that have been affected by post-Bakken erosion is twofold: 1) where is the Upper Black Shale Member missing and 2) where the Upper Black Shale Member is missing, as delineated through part 1, are the overlying Mississippian carbonates present. If the Upper Black Shale Member is missing, but is overlain by Mississippian carbonates, then non-deposition may be the cause. However, if the Upper Black Shale Member and overlying Mississippian carbonates are both missing, then sub-Mesozoic erosion may have affected the distribution of the Bakken in these parts of the study area.

The zero edge on both the Upper Black Shale Member and Mississippian carbonate isopach maps coincide with one another quite well, with a northwest to southeast trend through the study area that starts in townships 35 and 36, range 28W3 and terminates around township 32 to the south. All of the Bakken deposits that are located across the zero edge of the Upper Black Shale Member or Mississippian carbonates are interpreted as having been affected by post-Bakken erosion (Figure 4.12).

By overlaying the zero edge delineated in the isopach maps from the Upper Black Shale Members and the Mississippian carbonates onto the underlying facies associations, there is a general trend that shows areas with thinner overall deposits falling within this area of uncertainty. This area of uncertainty affects not only the distribution of the marginal-marine deposits from FA2, but potentially those of FA1 (lower) as well.

When the zero edge from the Upper Black Shale Member/Mississippian carbonates is overlain onto the isopach map of FA2 **(**Figure 4.13), the areas previously described as showing overall thin distribution within FA2 appear to fall within this area of uncertainty, which may attribute for the overall thinner distribution of FA2 is this part of the study area. Originally, FA2 deposits may have been thicker in this central part of the study, with subsequent erosion either removing or reworking marginal-marine deposits in this area. The intervening thins of FA2 in the northern part of the study area may also be attributed to post-Bakken erosion cutting through the FA2 deposits normal to the northeast/southwest trend of these deposits.

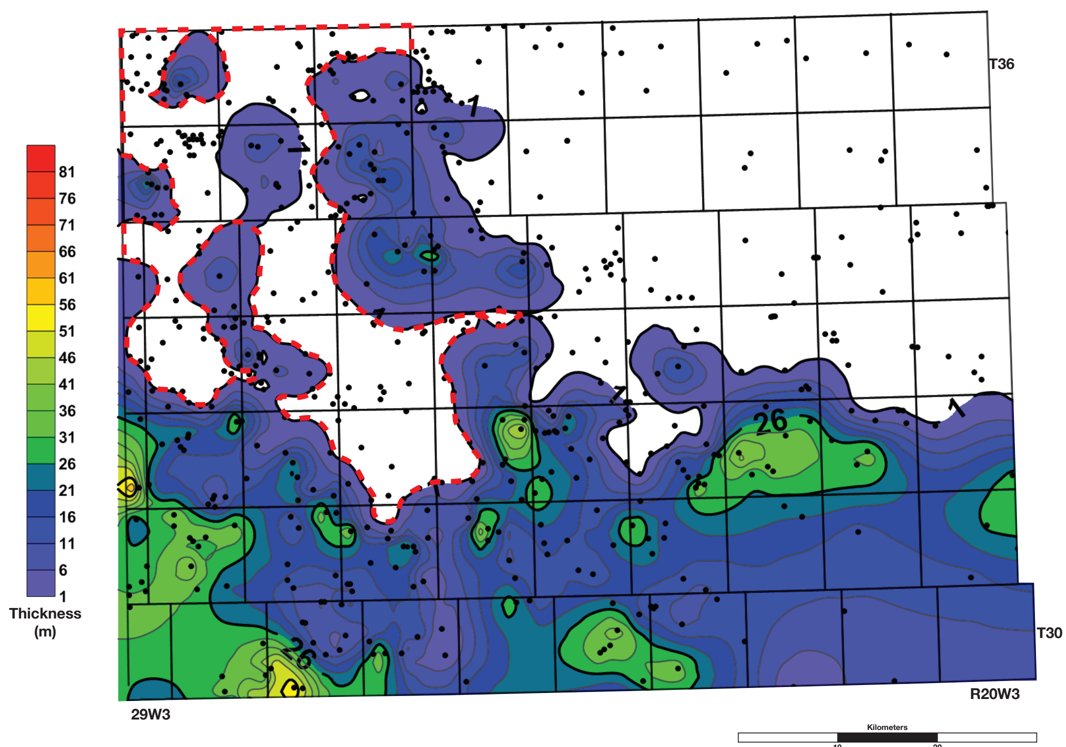

Figure 4.12 – Isopach map of the Mississippian carbonates that overlie the Bakken Formation with the zero edge delineated (red dashed line). All of the Bakken deposited beyond the zero edge has potentially been affected by post-Mississippian erosion.

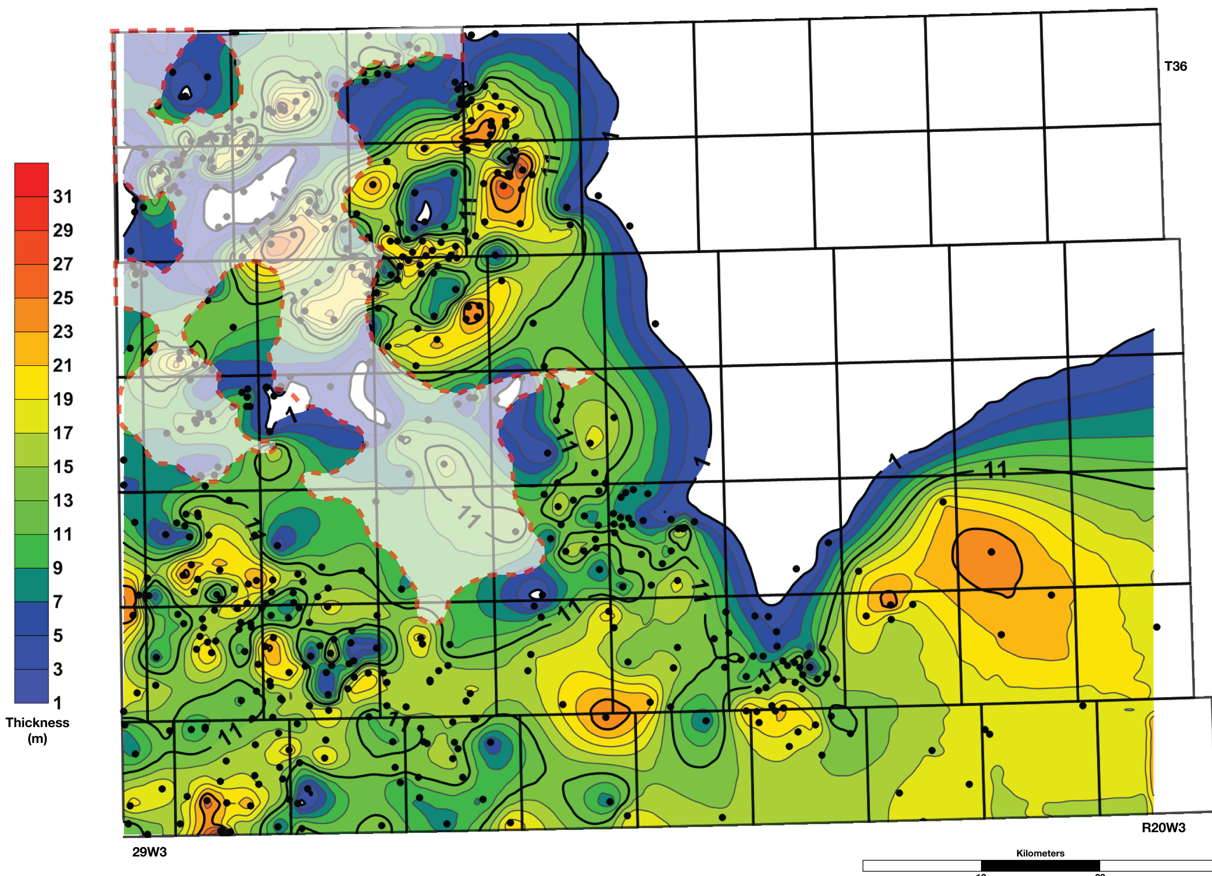

Figure 4.13 – Isopach map of FA2 with the Mississippian zero edge overlain. Parts of the isopach map that are overlain by white may have been affected by post-Mississippian erosion, which may account for the central part of the study area being thinner than the northern and southern parts of the study area. Post-Mississippian erosion may also account for the more pronounced thinning and thickening of FA2 in the northwestern part of the study area.

The lower open-marine deposits of FA1 (lower) may also have been affected by post-Bakken erosion in the areas that lie beyond the Upper Black Shale Member/Mississippian carbonate zero edge, although if FA1 (lower) is overlain by FA2 then it has most likely been minimally affected by post-Mississippian erosion (Figure 4.14; Figure 4.15). The fact that FA1 (lower) does not consistently extend beyond the southern part of the study area, other than the Lower Black Shale Member, may indicate removal of more proximal deposits similar to those of F3 that may have been more widespread before erosion.

Although the overall north-south/northwest-southwest deepening trend illustrated by the Big Valley Formation may be quite consistent, it may in fact have been more regular than what is seen, due to parts of the Big Valley structure surface coinciding with the Sub-Mesozoic unconformity surface, therefore not reflecting the original surface attitude.

The anomalous paleolow previously described in townships 32 and 33, range 23W3 may be indicative of that low actually illustrating the sub-Mesozoic unconformity surface (Figure 4.16; 4.17; 4.18). The absence of any Bakken sediments within this paleolow is further evidence towards this observation, which therefore does not allow for the inclusion of this paleolow in the overall north-south/northeast-southwest deepening trend previously described. Although this paleolow is to be excluded, it does not change the overall depth profile that has previously been established. Christopher (2003) illustrated that the Mississippian of west-central Saskatchewan was heavily influenced by post-Mississippian erosion, with paleo-valleys within which Lower Cretaceous sediments were deposited running through the study area for this thesis (Figure 4.19).

This paleolow that is now attributed to reflect coincidence of the Big Valley structural surface and the sub-Mesozoic unconformity surface appears to have been connected to the west by coincident lows on the two previously mentioned that occur along township 34, ranges 26W3 and 25W3.

Due to the heavy influence of post-Mississippian erosion on the thickness and distribution of Bakken sediments, stratigraphic cross-sections across much of the study area and their accompanying morphologies cannot be interpreted with confidence due to the lack of a complete sequence and potential reworking of Bakken sediments (cf. Toews, 2005), therefore a depositional model will be constructed based on the distribution found on geological isopach maps.

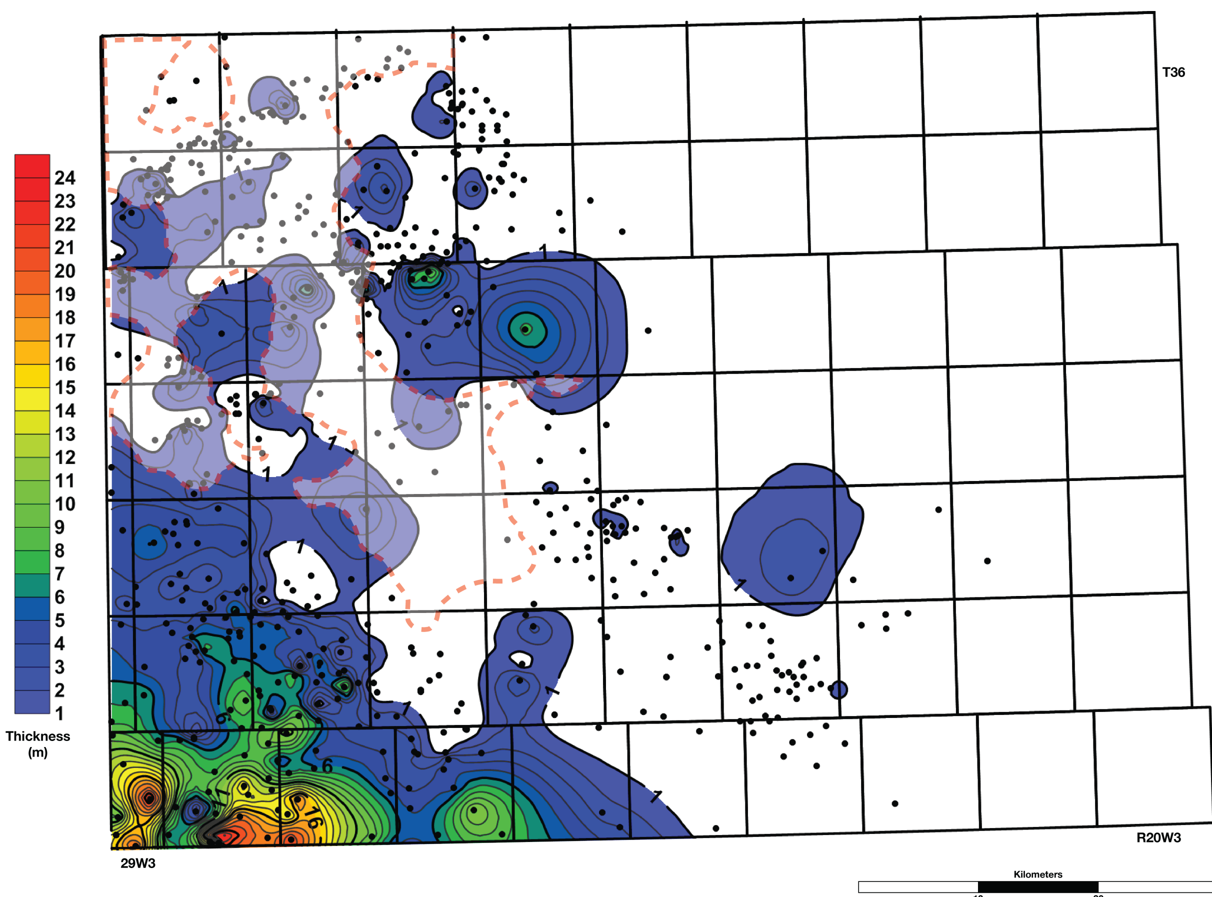

Figure 4.14 – Isopach map of F2/F3 with the Mississippian zero edge overlain. The initial distribution of F2/F3 may have been more extensive than what the isopach shows, with post-Mississippian erosion having potentially removed shallower expression of F2/F3.

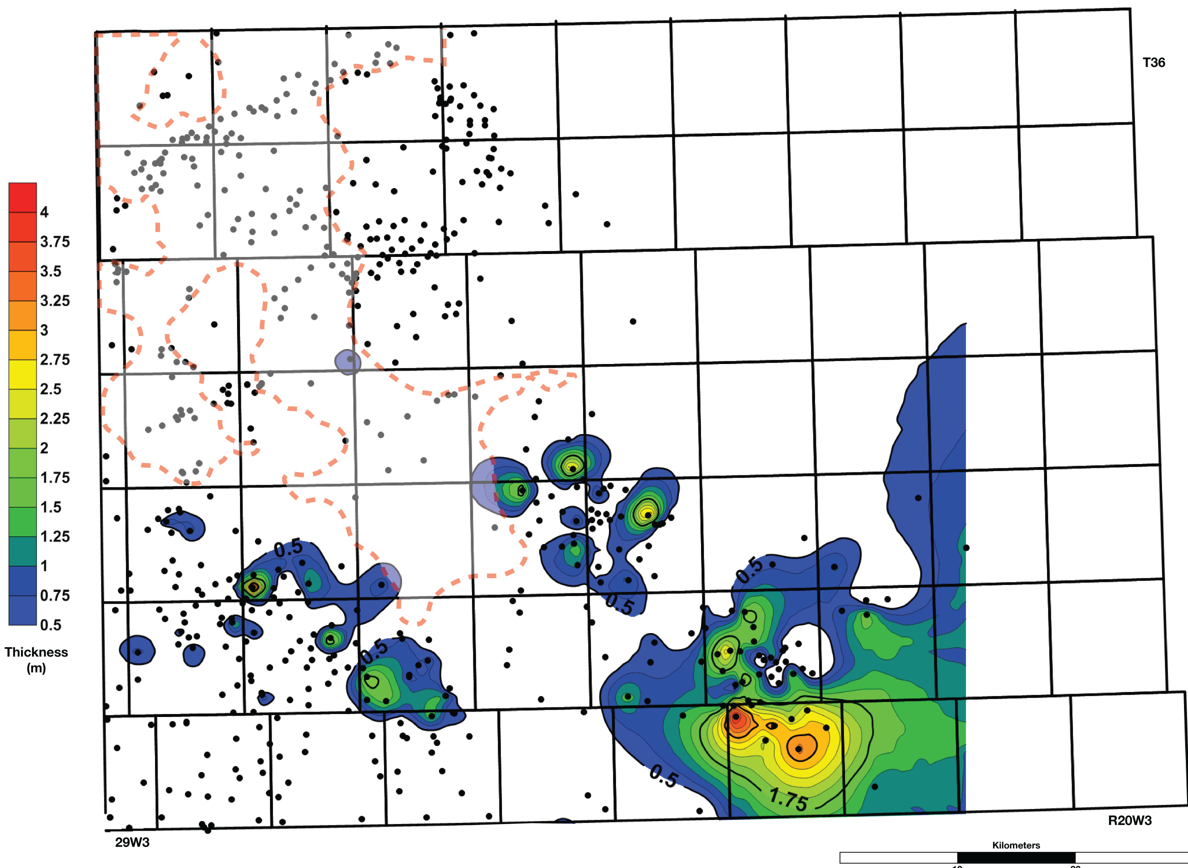

Figure 4.15 – Isopach map of F4 with the Mississippian zero edge overlain. As with F2/F3, post-Mississippian erosion may have removed F3 throughout the central part of the study area, accounting for the patchy distribution throughout T31 and T32.

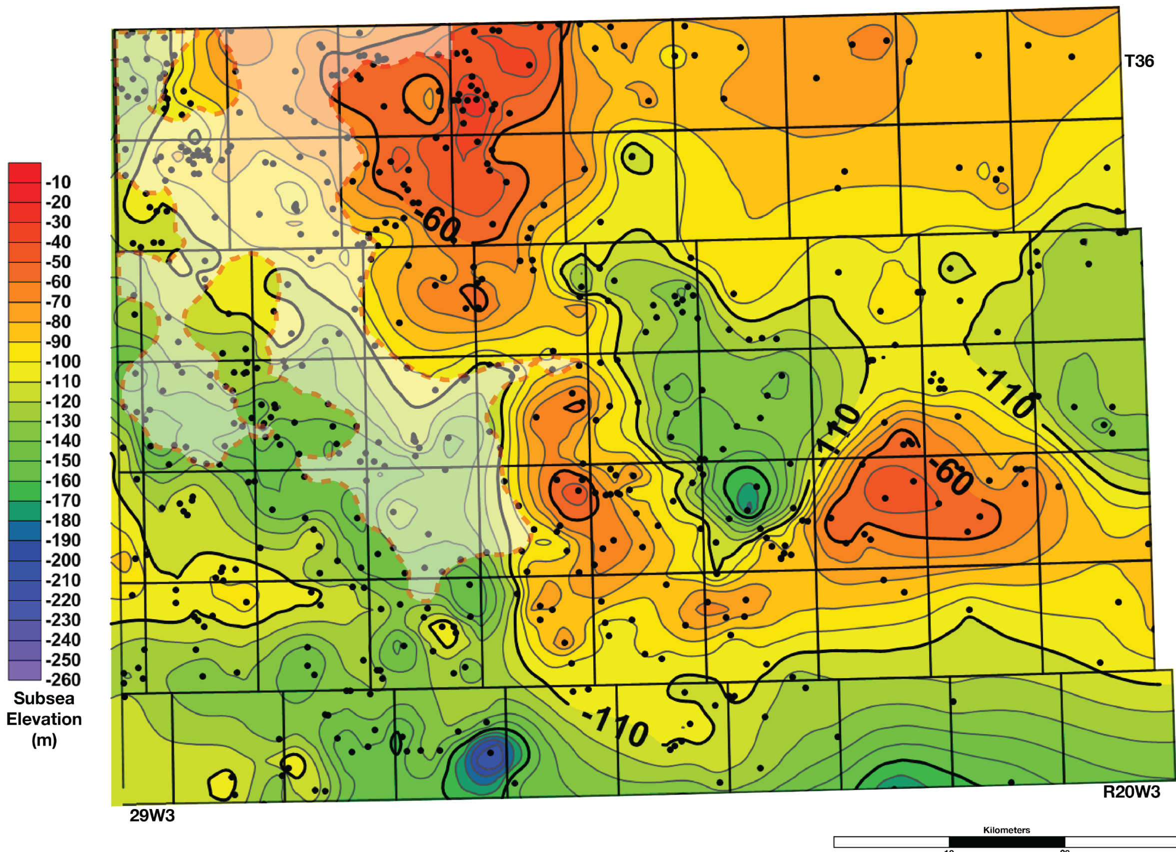

Figure 4.16 – Structure surface map of the sub-Mesozoic unconformity with the Mississippian zero edge overlain. The area beyond the zero edge appears to follow a paleolow that may have been part of the Lower Cretaceous valley system created by incision, affecting lateral distribution of the Bakken Formation and overlying Mississippian carbonates.

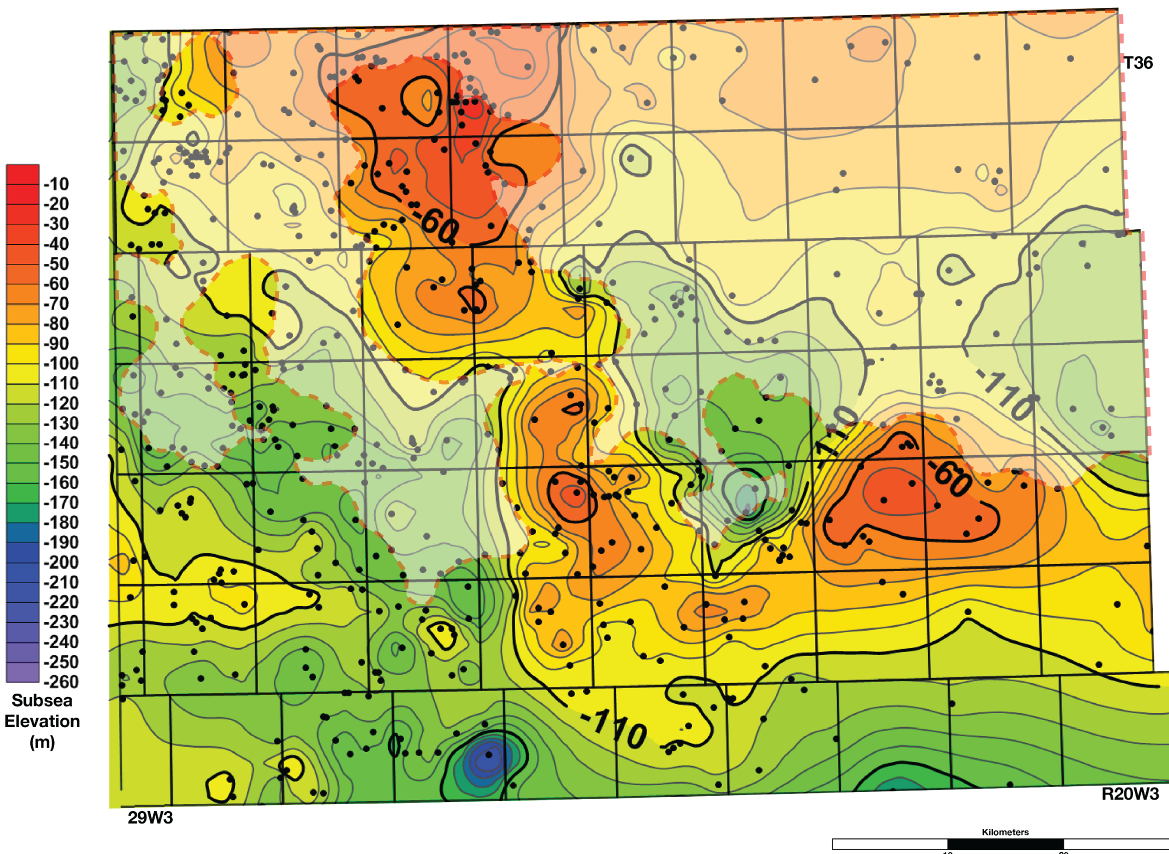

Figure 4.17 – Structure surface map of the sub-Mesozoic unconformity with the complete Mississippian zero edge overlain, without taking into account the presence of Bakken Formation sediments, illustrating the paleolow in T32 and T33, R23W3 potentially having been a result of post-Mississippian erosion.

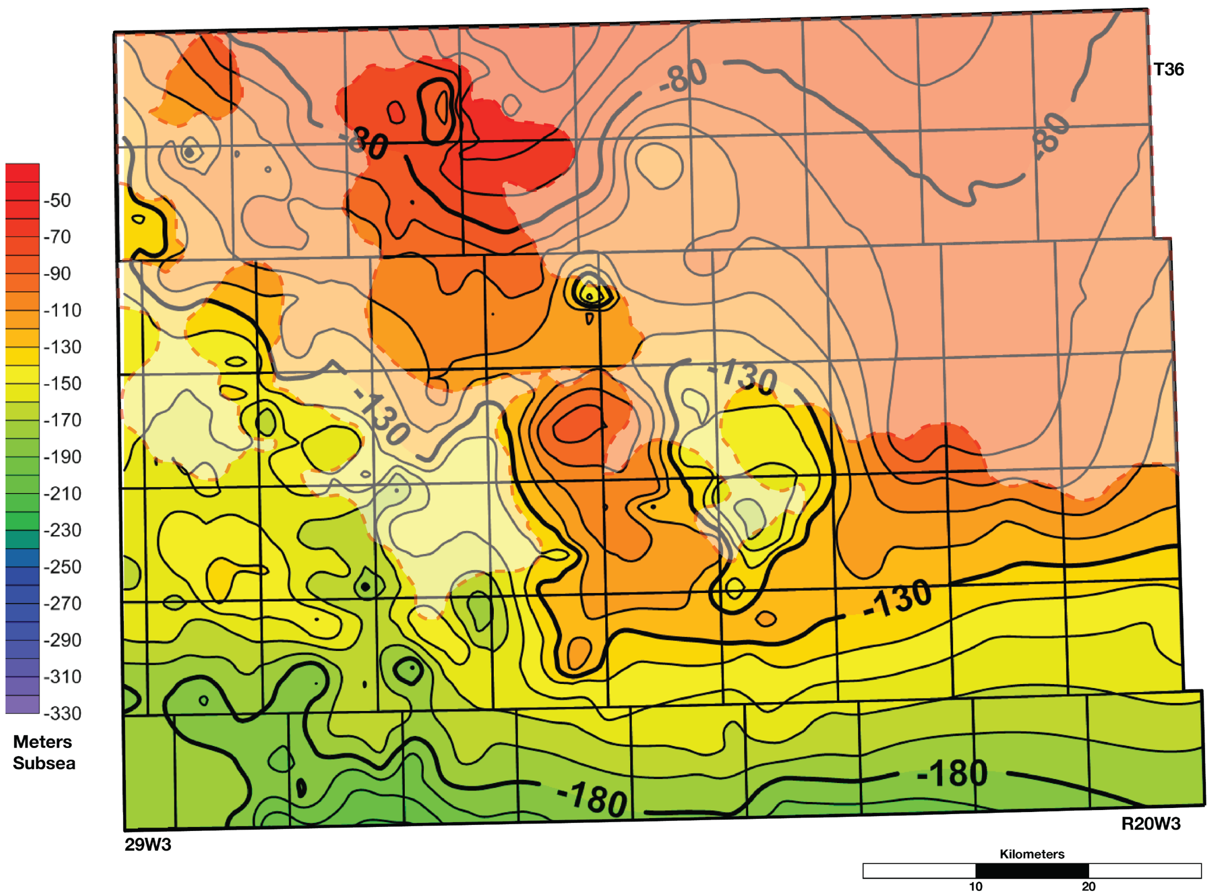

Figure 4.18 – Structure surface map of the Big Valley Formation with complete Mississippian zero edge overlain, irrespective of the presence of Bakken Formation sediments, illustrating the anomalous paleolow in T32 and T33, R23W3 in fact representing sub-Mesozoic structure.

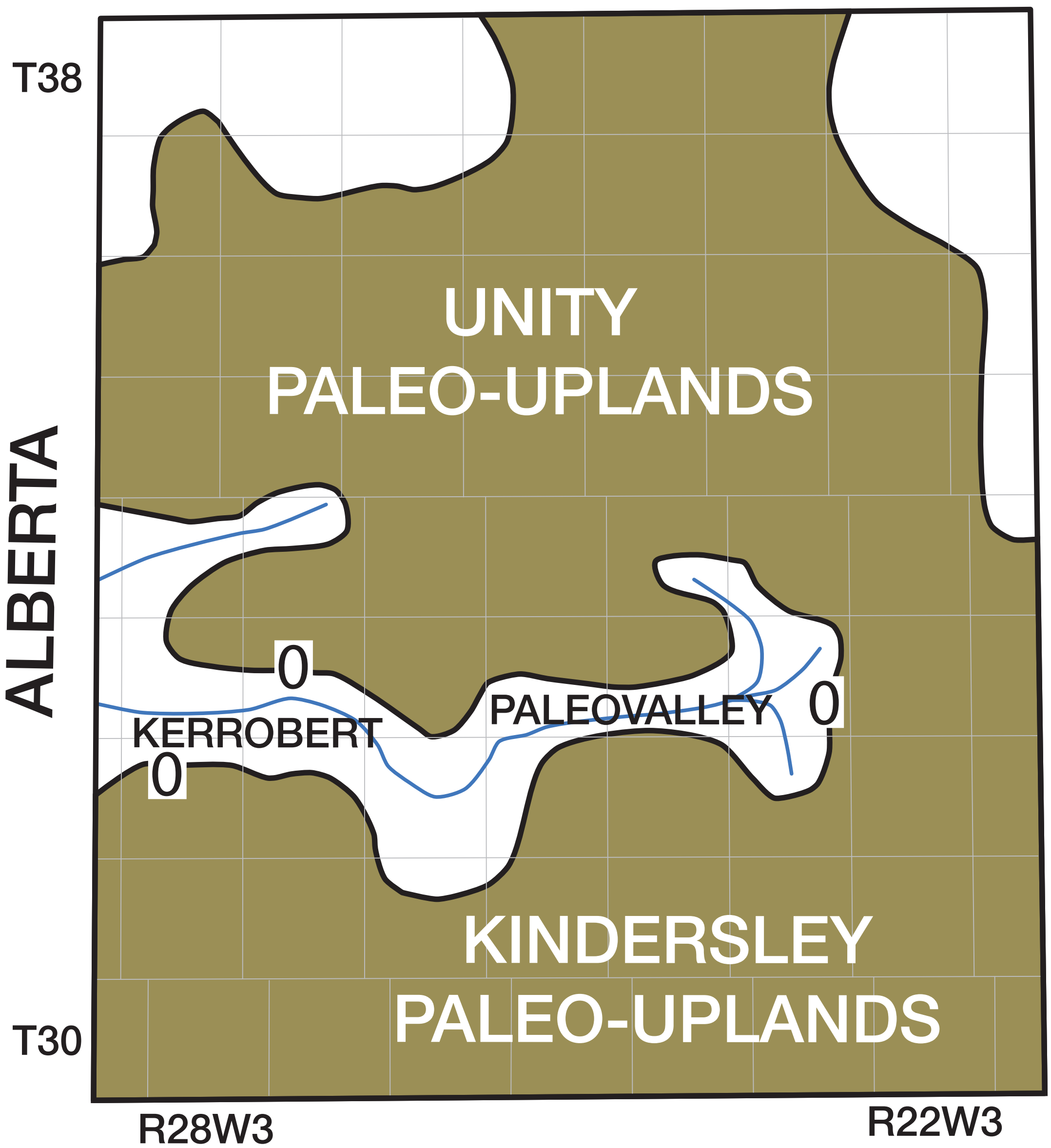

Figure 4.19 – Diagram displaying sub-Cantuar paleotopography, which coincides with the sub-Mesozoic unconformity across the study area. The paleovalley appears to coincide with the area of uncertainty delineated on previous maps in this study (modified from Christopher, 2003).

4.5 Depositional Model

4.5.1 Introduction

The depositional model proposed in this section is not placed within a high-frequency sequence stratigraphic model due to the previously mentioned effects of post-Bakken erosion that has potentially removed or reworked Bakken sediments throughout much of the study area. Due to the poor lateral distribution of Bakken strata, the depositional model will utilize a simplified sea level curve based on the systems tracts outlined by Catuneanu et al. (2009): Lowstand Systems Tract (LST), Transgressive Systems Tract (TST), Highstand Systems Tract (HST), and Falling-Stage Systems Tract (FSST).

4.5.2 Lower Open-Marine Association

The lower open-marine association is characterized by F1, F2, F3, and F4 (Figure 4.20). The Lower Black Shale Member is continuous throughout most of the study area. It is interpreted as having been deposited in an open-marine shelf setting where dysoxic conditions were dominant (Egenhoff and Fishman, 2013). According to Smith and Bustin (2000), the underlying Big Valley Formation was capped by a fall in relative sea-level, to the point where subaerial exposure may have occurred. Following the deposition of the Big Valley Formation, a relative rise in sea-level would have occurred such that the Lower Black Shale Member was deposited, therefore F1 is being placed within an initial Transgressive Systems Tract (TST)/ early Highstand Systems Tract (HST), where the TST is evidenced by the unconformable surface between the Big Valley/Bakken Formation and the HST is illustrated by the deposition of the upper interval of the Lower Black Shale Member under open-marine conditions. Based on the presence of a TST and early HST, a maximum flooding surface (MFS) may be present within the

Lower Black Shale Member, coinciding with the first prograding clinoform at the transition from a transgressive systems tract to the highstand systems tract (Catuneanu, 2006). However, this surface is not observed and is being inferred.

Although the contact between F4 and the underlying Lower Black Shale Member (F1) has been shown to be erosional, this is more likely due to the high-energy environment within which F4 was deposited and not evidence of a potential sequence boundary. No evidence was recorded that showed an erosive contact between F2 and F1, even though the contact is sharp, therefore the contact is being interpreted as conformable.

Deposition of F2, F3, and F4 most likely occurred during the late stages of the highstand systems tract (HST). Following deposition of the Lower Black Shale Member, the restricted conditions within the environment disappeared, which led to well-oxygenated conditions under which the lower open-marine association was deposited. This change from restricted to unrestricted conditions is evidenced by the heavily bioturbated F2 as well as the body fossils found within F2 and F4. During the late stages of the highstand systems tract, open-marine facies were deposited and may have prograded basinward, which accounts for the thickest accumulations of the lower open-marine facies association being in the southern parts of the study area.

As previously discussed, post-Bakken erosion has affected the lateral distribution of clastics throughout the study area. It is possible that more proximal instances may have been removed or reworked. Perhaps F3, which is restricted to the very southwestern part of the study area, was also deposited towards the northeast however was subsequently removed. Likewise, F4 may have been more continuous across the study area instead of restricted to the very southeastern parts of the study area.

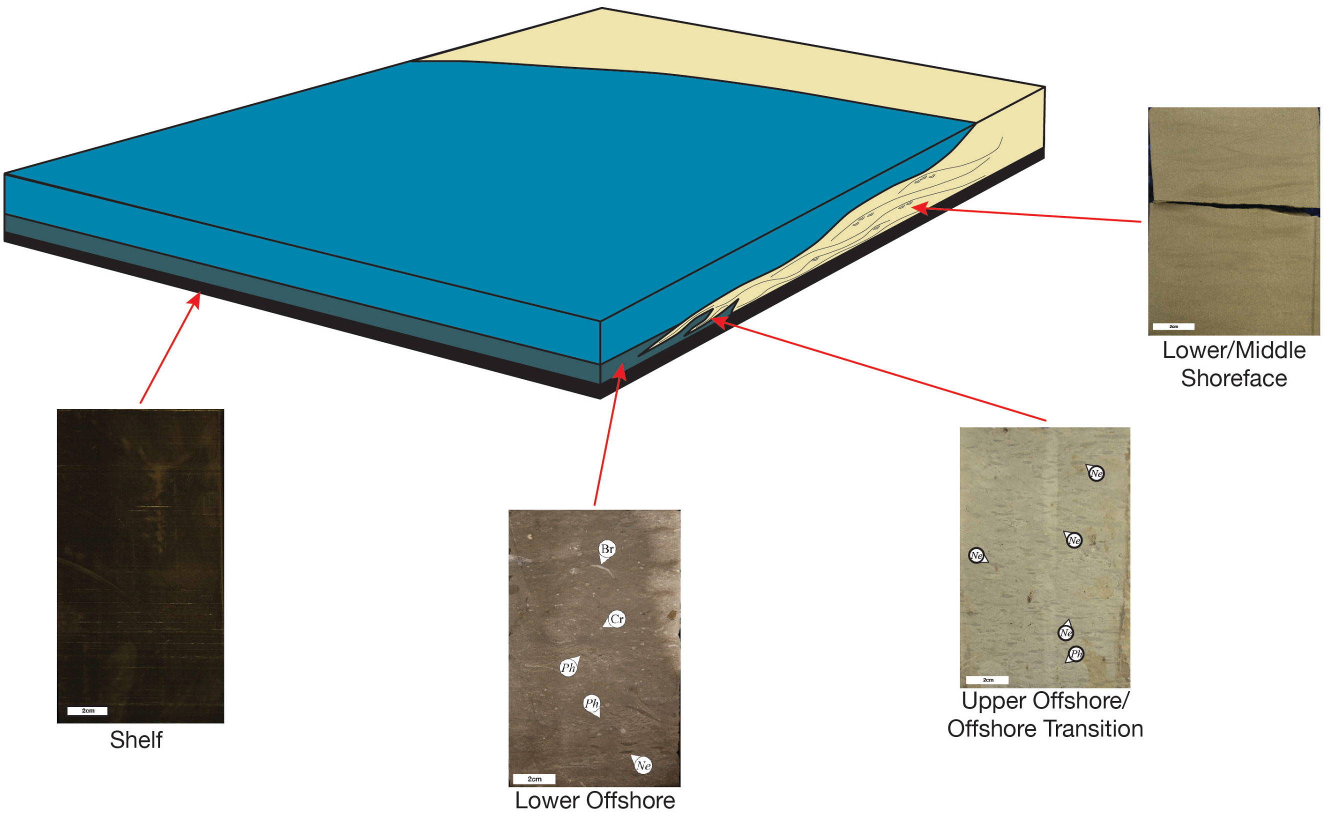

Figure 4.1 – Depositional model of facies association 1 (open-marine), showing the deposition of F1, F2 and F3 along the depositional profile of a prograding, wave-dominated environment.

4.5.3 Marginal-Marine Association

The marginal-marine association, which is made up of F5, F6, F7, and F8 was deposited above the lower open-marine association. Deposition can be broken down into two main stages: an initial falling-stage systems tract followed by a subsequent transgressive systems tract.

The deposition of F5 and F6 appears to have been an autocyclic succession of laterally continuous channel-related tidal flats. Tidal channels migrated laterally across the study area flanked by tidal flats (Figure 4.21). There is no straightforward stacking pattern seen between F5 and F6 where one always occurs above the other, which is why they are interpreted as having been deposited contemporaneously. Following the lower open-marine association, a subsequent fall in relative sea-level, potentially coupled with an increase in terrigenous sediment may have initiated deposition of F5/F6. Desjardins et al. (2012) described the potential for progradation of tidal flat deposits during a falling-stage systems tract under forced-regressive circumstances, where sea-level is falling irrespective of sediment supply. This may have been the case during deposition of F5/F6. A forced regression may have allowed for progradation of these channel-related tidal flats across the study area, which accounts for the relatively wide distribution of the middle marginal-marine association. Marginal-marine conditions have been interpreted based on the overall paucity of bioturbation. Although forced regressions occur irrespective of sediment supply, increased fluvial discharge coupled with a forced regression may have led to brackish conditions throughout the study area.

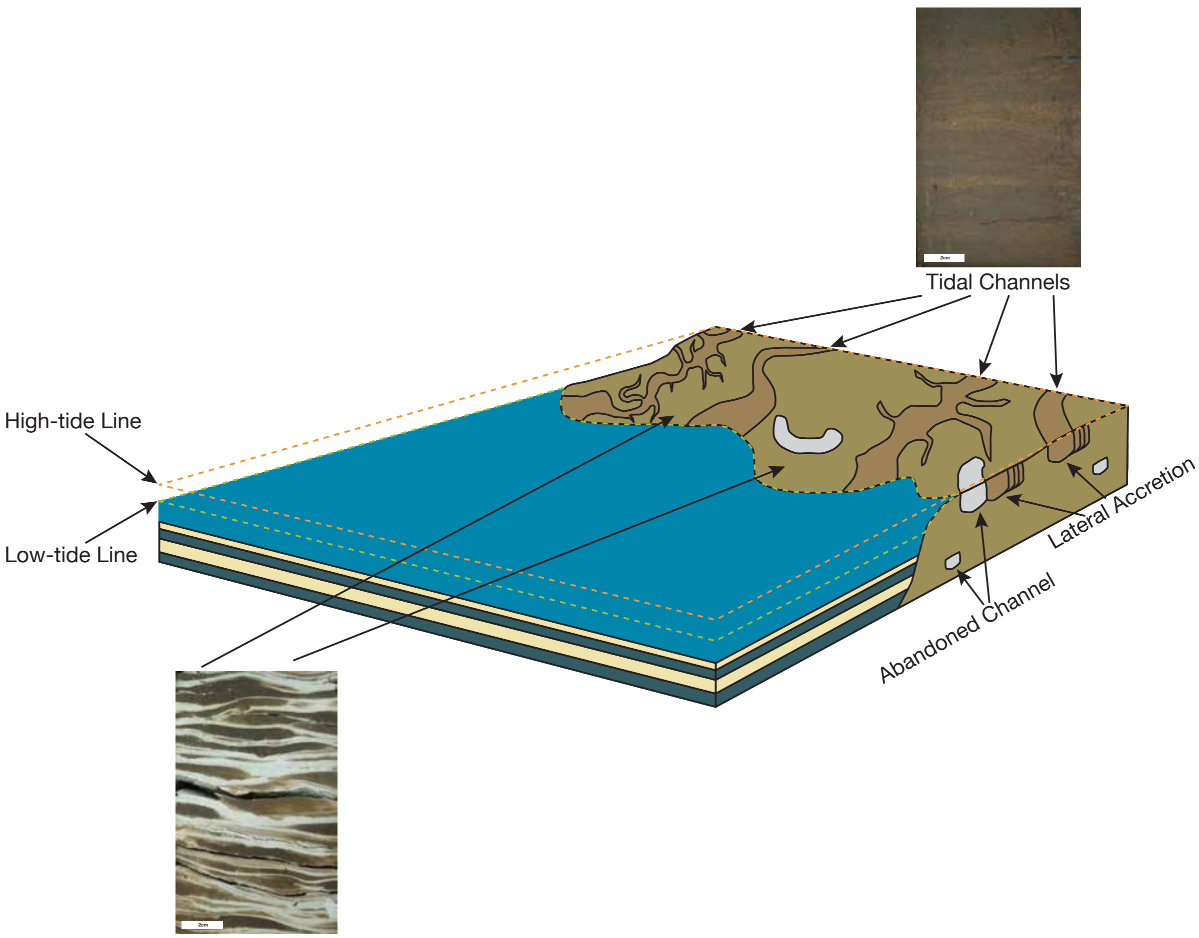

Figure 4.1 – Depositional model of facies association 2, showing meandering tidal channels flanked by tidal flats. Deposition within channels occurs laterally, and is generally sand-dominated, whereas tidal flat depositional tends to be more heterolithic.

Following the progradation of F5/F6 during the FSST, F8 was deposited during a subsequent transgression. There is no evidence of a lowstand systems tract within the study area. It is likely that sediment bypass during LST is the cause for this, or removal during the subsequent transgression. The contact between FSST and the subsequent TST is therefore being interpreted as a sequence boundary in the form of a co-planar surface of transgressive erosion. The lowstand systems tract would most likely have contained fluvial deposits in a landward direction as well, for which there is no evidence. These fluvial lowstand deposits may have been deposited further to the northeast, beyond the current Bakken Formation zero edge, and were likely not preserved. During the subsequent transgressive systems tract, marginal-marine conditions gradually were replaced by open-marine conditions, which is reflected in the highly bioturbated F8.

4.5.4 Upper Open-Marine Association

The upper open-marine assemblage does not show consistent distribution throughout the study area. It is made up of thin deposits of F2 that are overlain by discontinuous deposits of F1. F2 and F1 are interpreted as having been deposited during continued transgression during the late stages of the transgressive systems tract. The continued transgression brought with it the re-establishment of open-marine conditions, which is reflected in the deposition of F2 following F8.

The Upper Black Shale Member (F1) was most likely deposited during the late stages of the transgressive systems tract. Anoxic/dysoxic conditions returned, which in turn saw the deposition of black shales once again. The contact between the upper open-marine association and the Upper Black Shale Member is gradational and therefore interpreted as conformable. The poor distribution and overall thin nature of the upper open-marine association is attributed to post-Bakken erosion.

4.5.5 Summary

The Bakken of west-central Saskatchewan is characterized by two transgressions and one regression (Figure 4.22; 4.23). The Upper Black Shale Member was deposited during an initial transgression (TST1) and the subsequent early highstand systems tract (HST1). The upper open-marine assemblage was deposited during the late stages of HST1, following re-establishment of open-marine conditions. A subsequent fall in sea level (FSST) through a forced regression was conducive to the progradation of the lower marginal-marine association (F5/F6/F7); increased freshwater discharge created brackish-water conditions. Following FSST, a subsequent transgression (TST2) account for the deposition of the upper marginal-marine association (F8), where marine influence increased, evidenced by an increase in bioturbation. Continued transgression during TST2 resulted in the re-establishment of open-marine conditions and the subsequent deposition of the upper open-marine assemblage. The lack of a lowstand systems tract between FSST and TST2 is attributed to sediment bypass or removal during the initiation of TST2 and is therefore not preserved.

Stratigraphic Unit	Facies Association	Facies	Environmental Interpretation	Systems Tract
Bakken Formation	Upper Black Shale Member	F1 (upper)	Shelf	late TST2
	FA1 (upper)	F2 (upper)	Offshore	
	FA2	F8	Bioturbated Tidal Deposit	early TST2
		F7	Paleosol	FSST
		F6	Tidal Channel	
		F5	Tidal Flat	
	FA1 (lower)	F4	Carbonate Shoal	late HST1
		F3	Lower Shoreface	
		F2 (lower)	Offshore	
	Lower Black Shale Member	F1 (lower)	Shelf	TST1/HST1

Figure 4.2 – Table summarizing the sequence stratigraphic model applied to the Bakken Formation of west-central Saskatchewan.

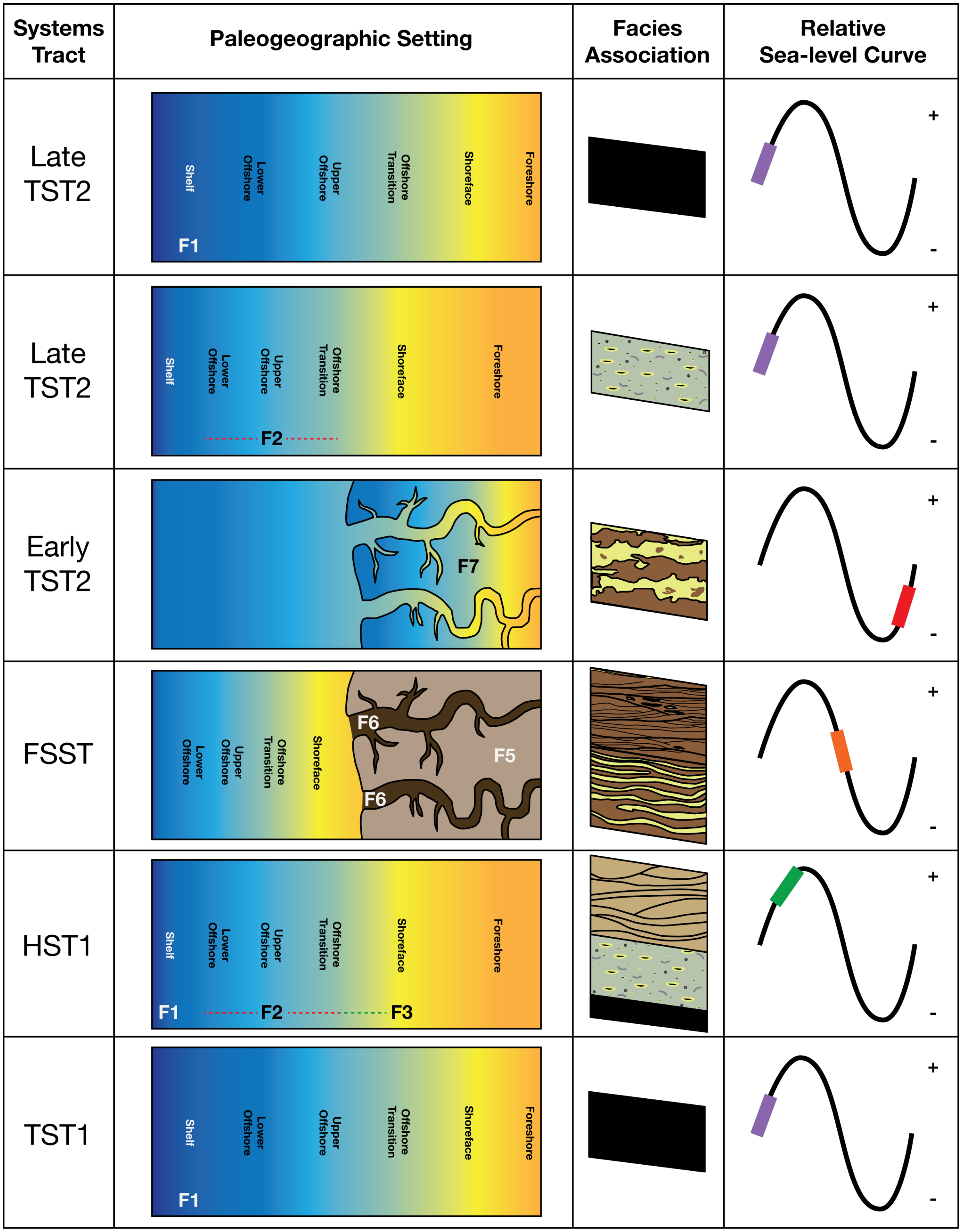

Figure 4.3 – Diagram summarizing the sequence stratigraphic evolution of the Bakken Formation, west-central Saskatchewan and potential paleogeographic settings during corresponding systems tract.

In southeastern Saskatchewan, recent studies have shown no evidence of a falling-stage systems tract, instead showing a highstand systems tract overlain by a transgressive systems tract, which is separated by a transgressive surface of erosion serving as a sequence boundary (Angulo and Buatois, 2012). Although the distance between the two areas is large, the FSST in west-central Saskatchewan may be indicative that a falling-stage systems tract could have occurred in southeastern Saskatchewan, but was not preserved or was reworked by the subsequent transgression.

Although there is most likely a sequence boundary within the Bakken Formation of west-central Saskatchewan, no evidence for such a surface has been observed. However, based on the stacking pattern of the systems tracts outlined in this chapter, the contact between the FSST and TST2 is being interpreted as a sequence boundary (SB). This contact is technically a co-planar surface of transgressive erosion (TSE) due to the lack of preservation of a lowstand systems tract between FSST and TST2. The effects of post-Bakken erosion cause problems in reconstructing a complete sequence stratigraphic model due to the potential removal of key units across much of the study area and therefore high-frequency sequence stratigraphic models should be performed with caution.

CHAPTER 5

5. ICHNOLOGIC ANALYSIS

5.1 Introduction

The basis for the grouping of the facies associations within this thesis is primarily based on the ichnological signature present throughout the study area. FA1, the open-marine association, has facies' characterized by the softground *Cruziana* ichnofacies. Within FA2, the marginal-marine association, there is an overall paucity of bioturbation, which is in part attributed to brackish conditions prevailing during deposition of F5 and F6 (tidal flats and tidal channels). This chapter will explore how ichnology is able to help in subdividing the Bakken Formation of west-central Saskatchewan into open-marine and marginal-marine facies associations.

5.2 Open-Marine Interval

The open-marine interval is where the main ichnological signature is present within the Bakken Formation of west-central Saskatchewan, with the majority of the interval being bioturbated to some degree.

The bioturbated siltstone of F2 **(**Figure 5.1) has been subdivided into Sf2A and Sf2B based on the ichnological signatures present. Both Sf2A and Sf2B are characterized by the distal *Cruziana* ichnofacies. *Phycosiphon incertum* is the dominant ichnotaxon in Sf2a, with subordinate *Nereites missouriensis* also present (Figure 5.1). Both of these ichnospecies are classified as produced by deposit feeders that graze along the water/sediment interface where food supply is deposited through suspension fallout. The presence of food supply within the upper part of the sediment is evidence for overall low energy conditions. Higher energy environments tend to keep the food supply suspended within the water column, favoring the establishment of burrows formed by infaunal suspension feeders that shelter themselves from the constant energy within the water column. Sf2B is also characterized by the "distal" *Cruziana* Ichnofacies, but *N. missouriensis* becomes the dominant ichnotaxon, with subordinate *P. incertum* and *Asterosoma* isp. (Figure 5.1).

The archetypal *Cruziana* Ichnofacies is commonly composed of locomotion, resting, feeding, dwelling, and grazing traces that are predominantly horizontal in nature (Buatois and Mángano, 2011). It has been subdivided by MacEachern et al. (1999; 2007) into proximal, archetypal, and distal *Cruziana* Ichnofacies with the archetypal *Cruziana* Ichnofacies being located between the upper offshore and offshore transition. The proximal *Cruziana* Ichnofacies is located in the direction of higher energy, which changes depending on the overall energy regime (i.e. wave-dominated versus tide-dominated), with the appearance of vertical burrows that characterize the *Skolithos* Ichnofacies. The distal *Cruziana* Ichnofacies occurs in the direction of waning energy relative to the archetypal *Cruziana* Ichnofacies, with specialized feeding and grazing traces dominating the ichnofabric. The presence of specialized feeding traces, such as *P. incertum* and *N. missouriensis,* within F2 is evidence for classification within the distal *Cruziana* Ichnofacies.

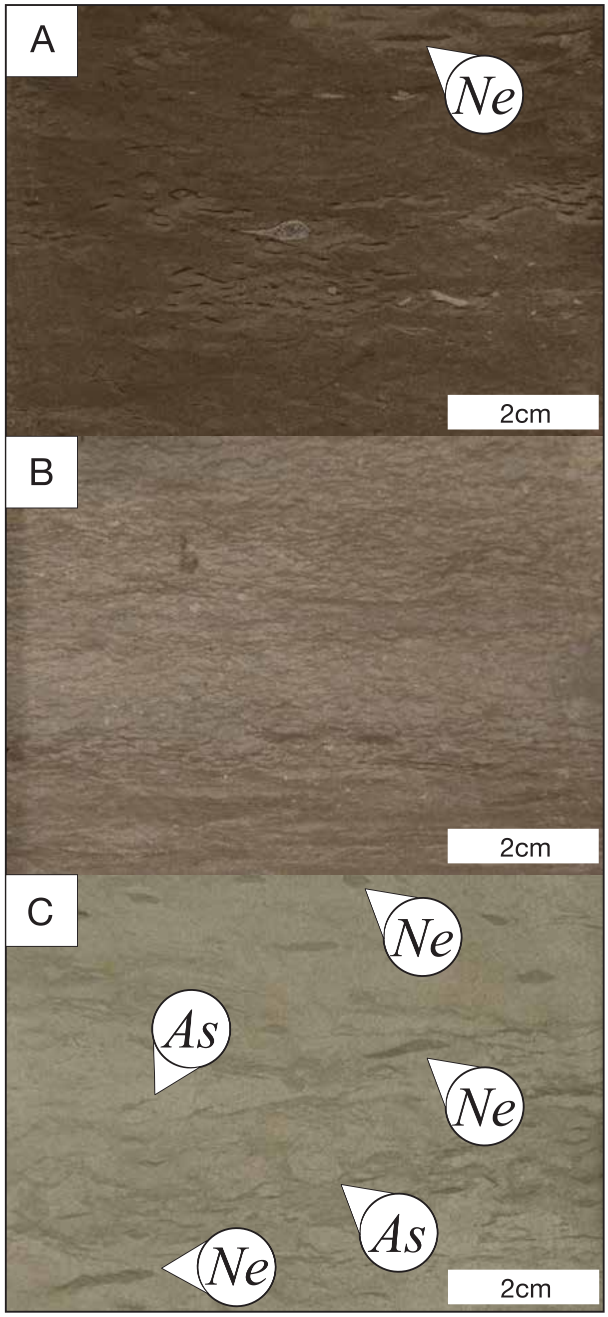

Figure 5.1 – Selected core photographs showing FA1, characterized by the distal *Cruziana* Ichnofacies. A) Core photograph of Sbf2A, showing *Nereites missouriensis (Ne)* and *Phycosiphon incertum*; B) Core photograph of Sbf2A, showing horizon heavily bioturbated by *Phycosiphon incertum*; C) Core photograph of Sbfa2B, showing dominant *N. missouriensis (Ne)* with subordinate *Asterosoma* isp. (*As*).

Shallow tier trace fossils are not recorded within the open-marine interval, which may be linked to the high level of bioturbation (BI 3-5). The deeper tier structures may have reworked shallower tier structures as organisms migrated upward during accumulation of sediment during deposition.

The lower to middle shoreface deposits that characterize F3 are unbioturbated. However, F3 has only been recorded in the southwestern corner of the study area and may have been removed in other parts of the study area due to post-Mississippian erosion. This leaves a very small sample size for whether or not F3 was indeed bioturbated. The relatively high-energy conditions would have further impeded infaunal colonization.

5.3 Marginal-Marine Interval

The marginal-marine interval of the Bakken Formation in west-central Saskatchewan is almost completely unbioturbated, with the exception of F7, the bioturbated tidal deposit that overlies F5, F6, and F8. The lack of bioturbation in F5 and F6 is being attributed to brackish conditions prevailing throughout the study area during deposition, causing problems for benthic communities to establish themselves.

The ichnofabric in F7 (Figure 5.2) is attributed to the initial rise in sea level of TST2, which began the re-establishment of open-marine conditions, with fully open-marine conditions being established during the late stages of TST2, as evidenced by F2 overlying FA2. The ichnological signature of F7 is characterized by feeding and dwelling structures, such as *Teichichnus rectus*, *Rosselia socialis*, *Planolites montanus*, and *Asterosoma* isp (Figure 5.2). The aforementioned ichnotaxa are understood to be produced by relatively shallow tier tracemakers, which indicates the initial increase in salinity that led to a low diversity, opportunistic benthic community made up of trophic generalists.

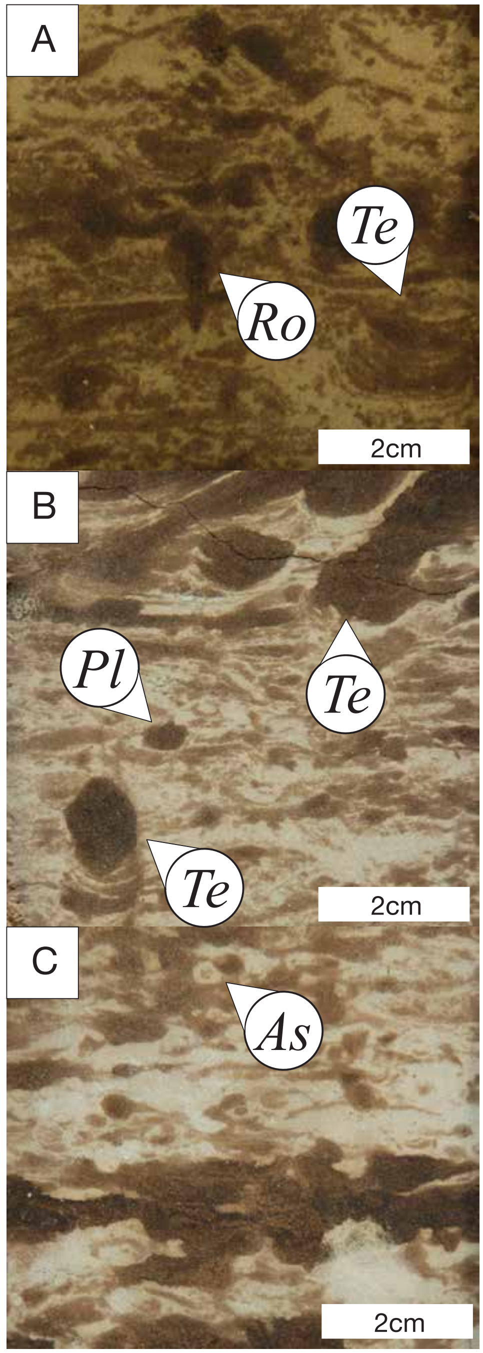

Figure 5.2 – Selected core photographs of F7 from FA2 (marginal-marine), characterized by shallow tier, trophic generalists, including *Rosselia socialis (Ro)*, *Teichichnus rectus (Te)*, *Planolites montanus (Pl)*, and *Asterosoma* isp. (*As*).

Had conditions been more suitable for colonization by a diverse benthic community (i.e. fully-marine), one would expect to see the emplacement of deeper tier traces with more sophisticated feeding strategies.

CHAPTER 6

6. CONCLUSIONS

The primary purpose of this study was to characterize the sedimentology, ichnology, and stratigraphic architecture of the Bakken Formation of west-central Saskatchewan. These goals were accomplished by combining detailed core descriptions of primary sedimentological features and ichnological signatures. Based on these characteristics the Bakken deposits were subsequently grouped into facies and facies associations; detailed geological maps (structure surface and isopach) were produced in order to create a depositional model placed within a sequence stratigraphic framework. Although the Bakken Formation of west-central Saskatchewan has previously been described with respect to sedimentology and stratigraphy, none have taken into account post-Mississippian erosion and its control on the distribution of Bakken Formation deposits.

Eight facies were defined based on sedimentological and ichnological characteristics described through the detailed analysis of seventy-nine cores: F1 (Upper and Lower Black Shale members), F2 (Bioturbated siltstone/sandy siltstone), F3 (Wave-rippled very-fined grained sandstone), F4 (Bioclastic grainstone), F5 (Interbedded mudstone, siltstone, and very fine- to fine-grained sandstone), F6 (Very fine- to fine-grained sandstone), F7 (Bioturbated siltstone/sandstone), and F8 (massive and brecciated mudstone).

Two facies associations were recognized in the Bakken Formation of west-central Saskatchewan. Facies association 1 (FA1) is characterized by an open-marine setting and facies association 2 (FA2) by a marginal-marine setting. FA2, which is characterized by F5, F6, F7, and F8, was deposited between lower and upper expressions of FA1, which is characterized by F1, F2, F3, and F4. FA1 (lower) was deposited during a late transgression (TST1) followed by progradation during a subsequent highstand systems tract (HST1). Marginal-marine conditions became established during the subsequent falling-stage systems tract (FSST), as F5/F6 prograded basinward. F7 was deposited during the early stages of the subsequent transgression (TST2), during which time environmental conditions began to revert back to an open-marine setting. Continued transgression (TST2) resulted in the reestablishment of fully open-marine conditions and deposition of FA1 (upper).

The interpretation of open-marine versus marginal-marine conditions is done primarily using ichnological evidence. The open-marine interval (FA1) is, for the most part, highly bioturbated and also contains body fossils of brachiopods and crinoids. The marginal-marine interval (FA2) is almost completely unbioturbated, which is in part attributed to turbidity within the water column, but also due to brackish-water conditions, which are evidenced by the low bioturbation in F5. The only bioturbated unit within FA2, F7, shows a low diversity trace-fossil association dominated by shallow tier trophic generalists. It was emplaced during the initial phase of TST2 during which time salinity would have began to increase.

The structural surface map of the underlying Big Valley Formation shows a general north-south/northeast-southwest deepening trend along which Bakken Formation sediments were deposited, although some of the Big Valley structural components are in fact illustrating structure of the sub-Mesozoic unconformity.

Mapping of the facies and facies associations, along with the underlying Big Valley Formation and overlying Mississippian carbonates/sub-Mesozoic unconformity has illustrated that post-Mississippian erosion was a strong controlling factor with regards to the distribution of Bakken Formation sediments, such that isopach maps and stratigraphic cross-sections of the Bakken often present an incomplete picture of the original architecture. Before interpreting geological maps and more importantly stratigraphic cross-sections, a full understanding of post-Mississippian erosion and deposition should be achieved.

Although this thesis attempts to take into account the pre- and post-depositional and erosional histories surrounding the Bakken Formation, it should be noted that dissolution of the underlying Devonian Prairie Evaporite Formation may have been a controlling factor with regards to overall distribution of the Bakken Formation. Although previous studies have alluded to such controls, no studies have investigated the impact of the Prairie Evaporite Formation on the distribution of the Bakken Formation. A comprehensive study of the Prairie Evaporite Formation could help to further explain the distribution of Bakken Formation sediments.

The Upper and Lower Black Shale Members of the Bakken Formation have, for the most part, been described as deposited under anoxic conditions. Although many studies surrounding the Bakken Formation have investigated the black shales in detail, they have commonly been with regards to their potential as a source rock. Recent studies have noted an ichnological fabric present within the black shale members, leading to the idea that they were not in fact deposited under anoxic but rather dysoxic conditions. A detailed ichnologic analysis of the black shale members of the Bakken Formation may aid in better understanding the conditions under which they were deposited.

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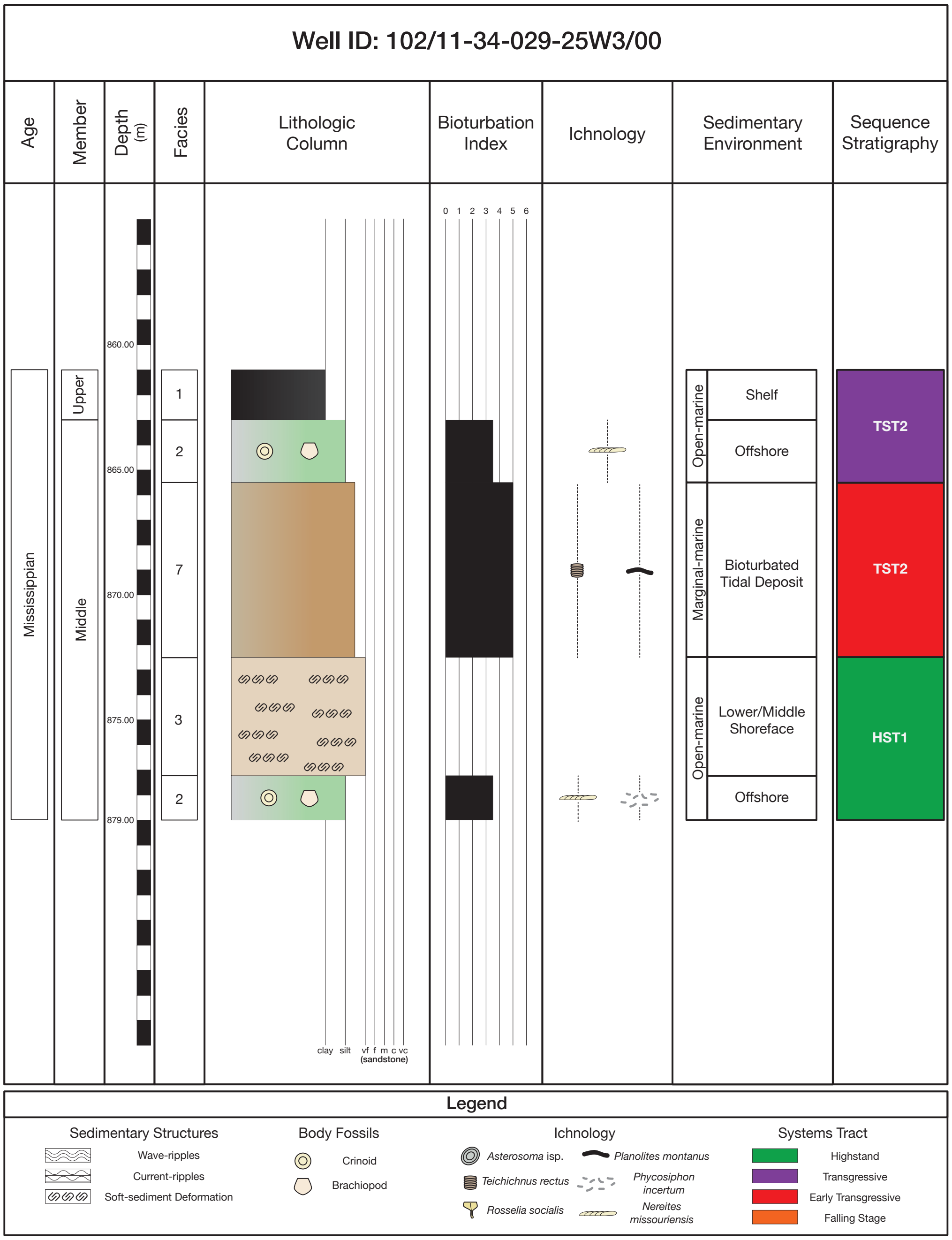
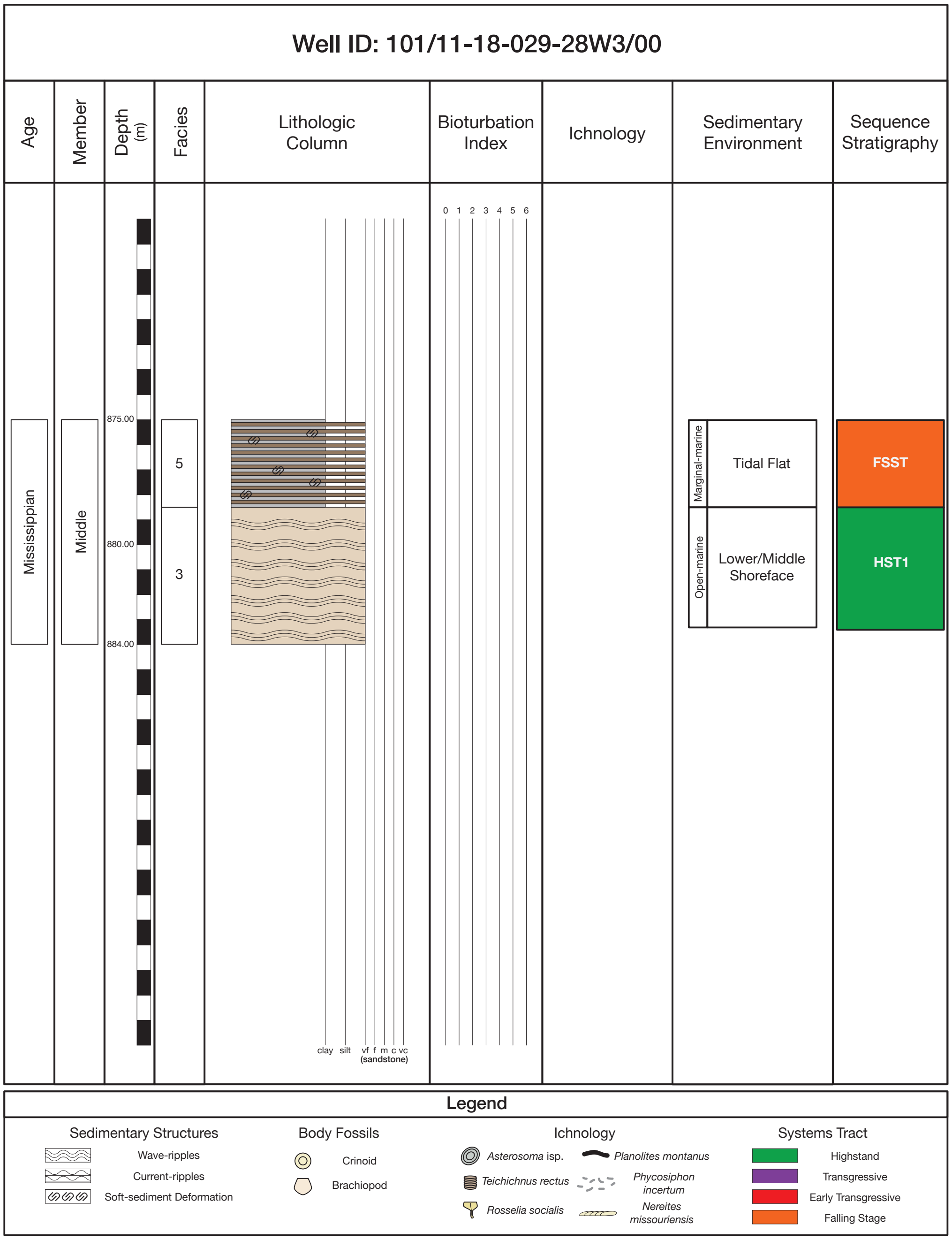
APPENDIX A

CORES LOGGED



Well ID: 102/11-34-029-25W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Upper
Middle
860.00
865.00
870.00
875.00
879.00
1
2
7
3
2
clay silt vf f m c vc (sandstone)
0 1 2 3 4 5 6
Open-marine
Shelf
Offshore
Marginal-marine
Bioturbated Tidal Deposit
Open-marine
Lower/Middle Shoreface
Offshore
TST2
TST2
HST1
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Teichichnus rectus
Rosselia socialis
Planolites montanus
Phycosiphon incertum
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage



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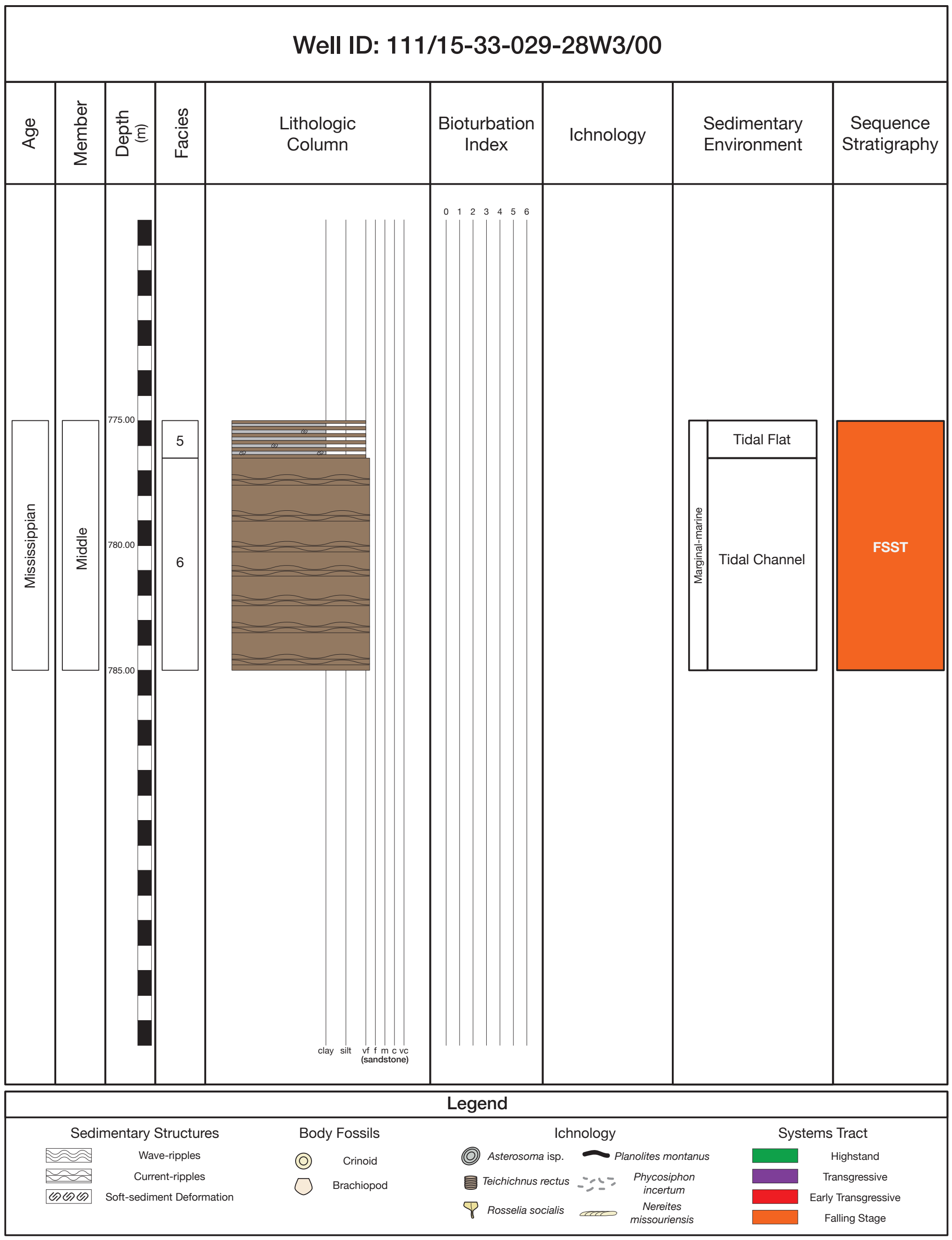
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
0 1 2 3 4 5 6
875.00
880.00
884.00
Mississippian
Middle
5
3
clay silt vf f m c vc (sandstone)
Marginal-marine
Tidal Flat
Open-marine
Lower/Middle Shoreface
FSST
HST1
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage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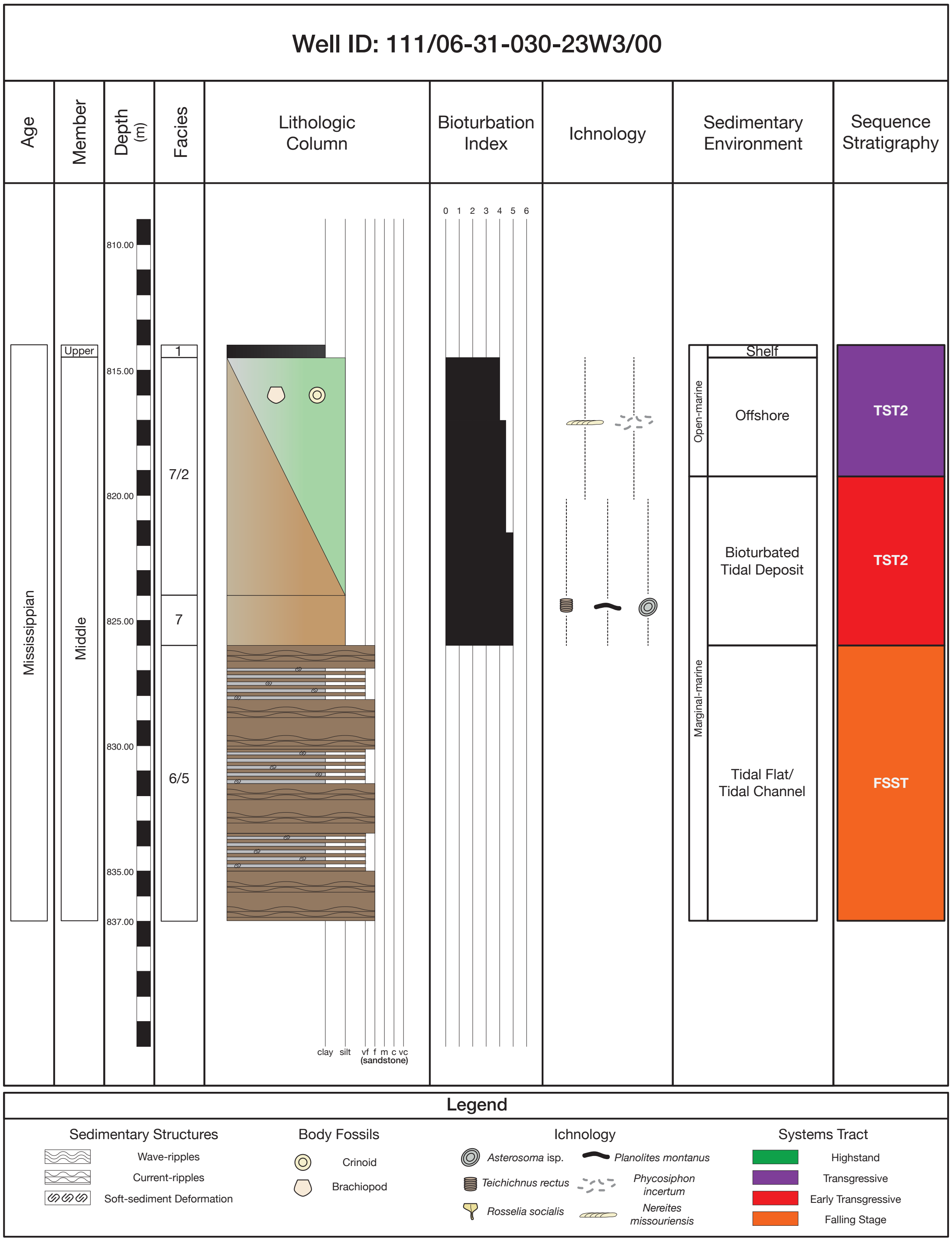
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
0 1 2 3 4 5 6
775.00
780.00
785.00
Mississippian
Middle
5
6
clay silt vf f m c vc
(sandstone)
Marginal-marine
Tidal Flat
Tidal Channel
FSST
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Teichichnus rectus
Rosselia socialis
Planolites montanus
Phycosiphon incertum
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage



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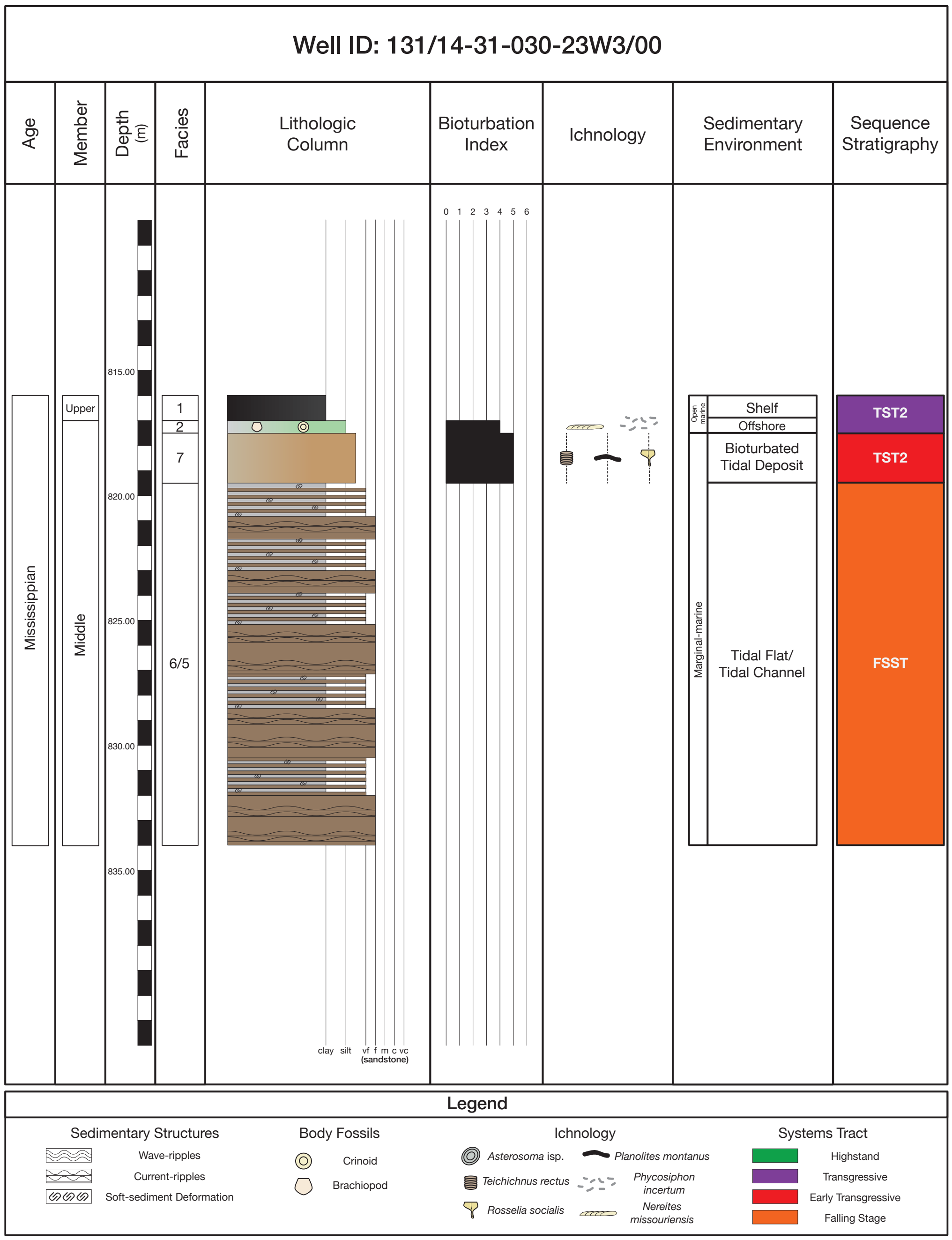
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Upper
Middle
810.00
815.00
820.00
825.00
830.00
835.00
837.00
1
7/2
7
6/5
clay silt vf f m c vc (sandstone)
0 1 2 3 4 5 6
Shelf
Open-marine
Offshore
Marginal-marine
Bioturbated Tidal Deposit
Tidal Flat/ Tidal Channel
TST2
TST2
FSST
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Teichichnus rectus
Rosselia socialis
Planolites montanus
Phycosiphon incertum
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage



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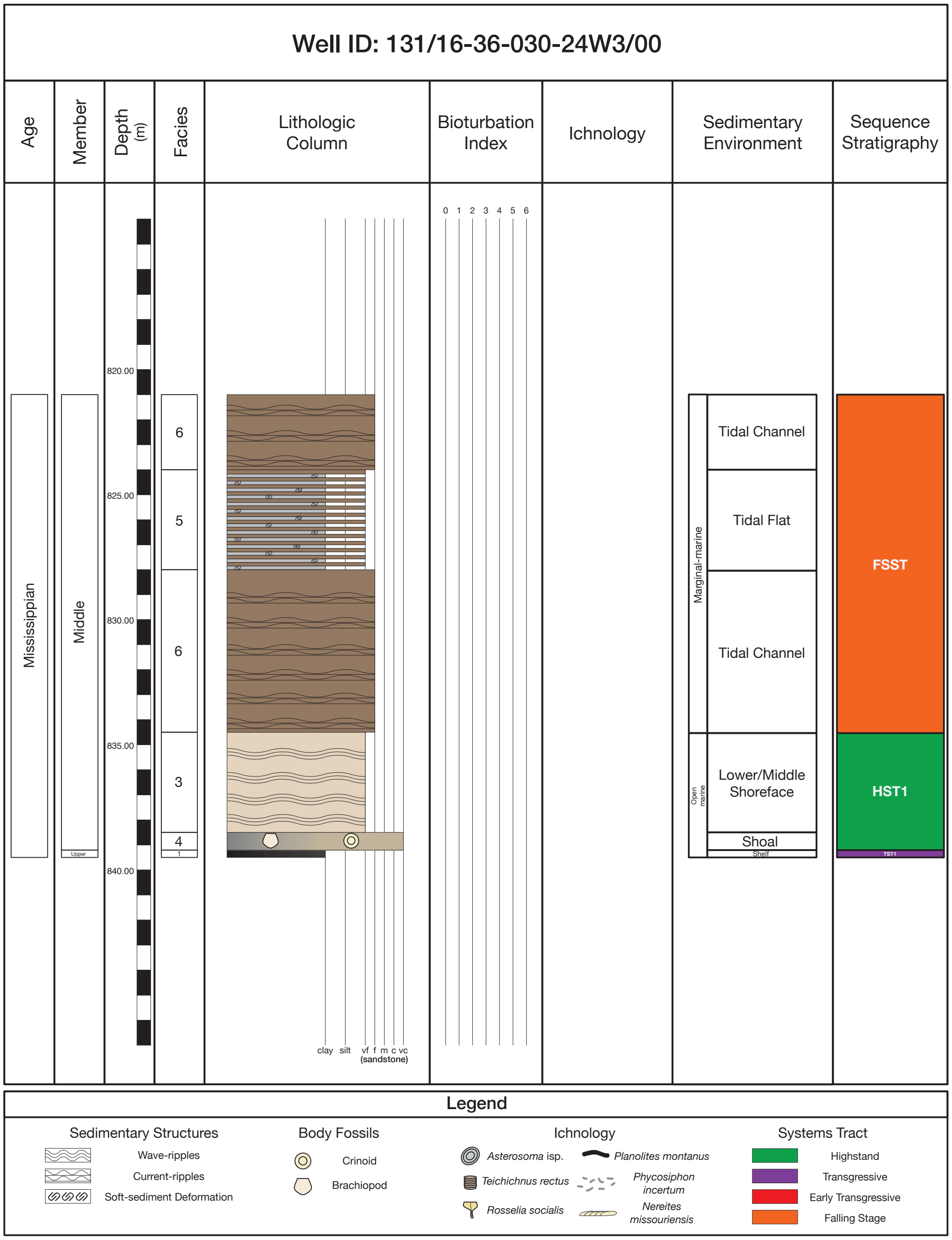
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Upper
Middle
815.00
820.00
825.00
830.00
835.00
1
2
7
6/5
0 1 2 3 4 5 6
clay silt vf f m c vc (sandstone)
Open marine
Marginal-marine
Shelf
Offshore
Bioturbated Tidal Deposit
Tidal Flat/ Tidal Channel
TST2
TST2
FSST
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage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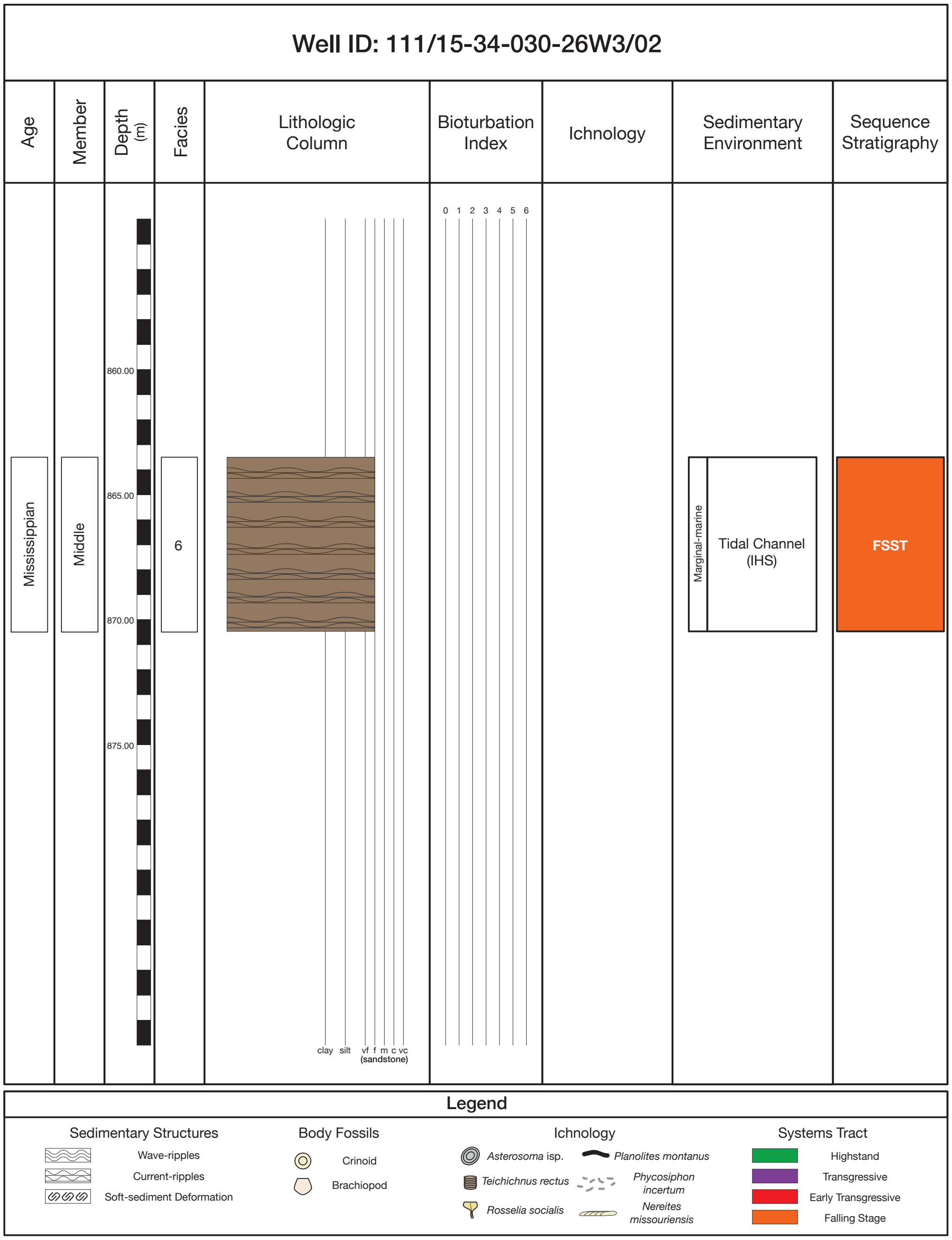
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Middle
Upper
820.00
825.00
830.00
835.00
840.00
6
5
6
3
4
1
0 1 2 3 4 5 6
clay silt vf f m c vc (sandstone)
Marginal-marine
Open marine
Tidal Channel
Tidal Flat
Tidal Channel
Lower/Middle Shoreface
Shoal
Shelf
FSST
HST1
TST1
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Teichichnus rectus
Rosselia socialis
Planolites montanus
Phycosiphon incertum
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage



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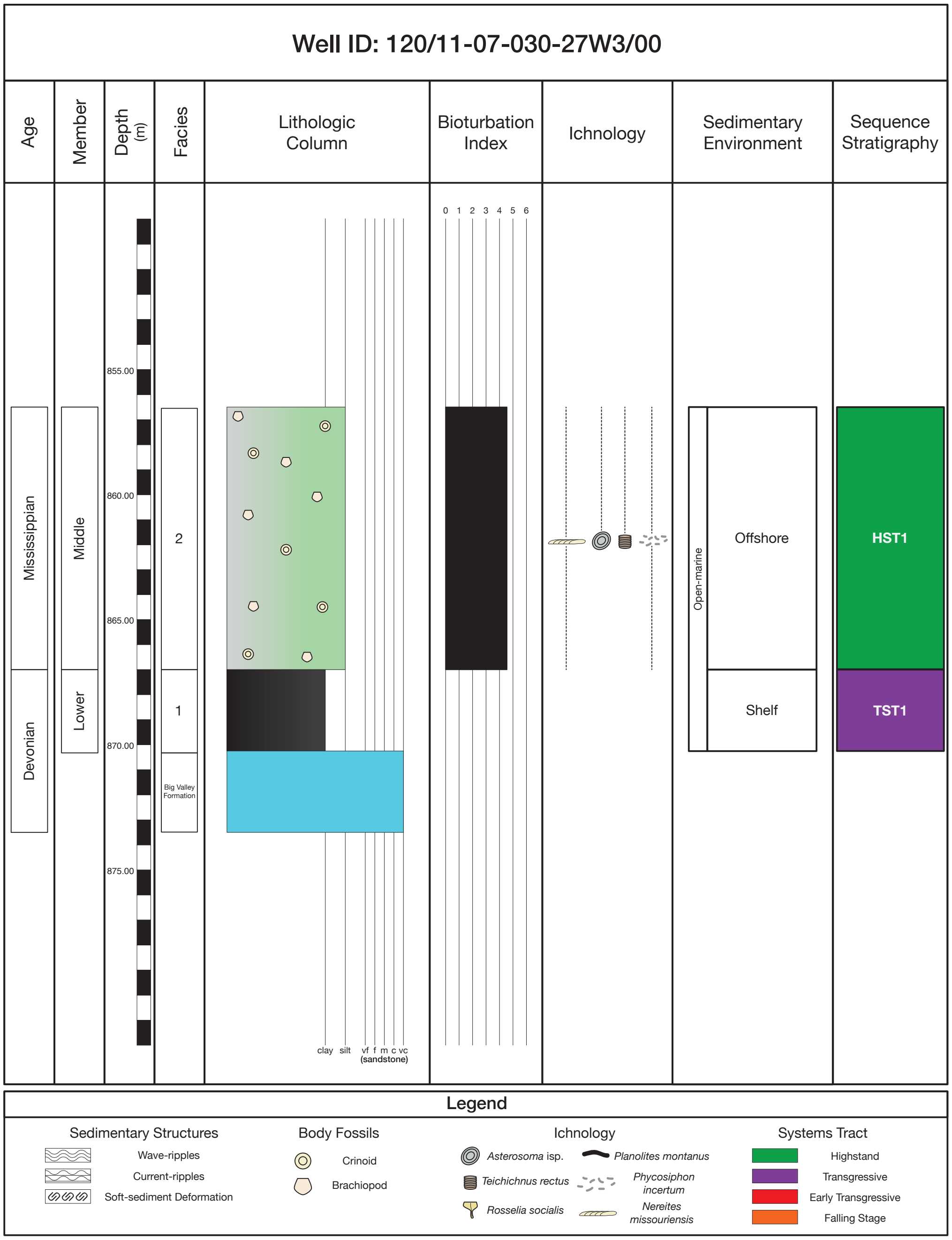
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
0 1 2 3 4 5 6
860.00
865.00
870.00
875.00
Mississippian
Middle
6
Marginal-marine
Tidal Channel (IHS)
FSST
clay silt vf f m c vc
(sandstone)
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage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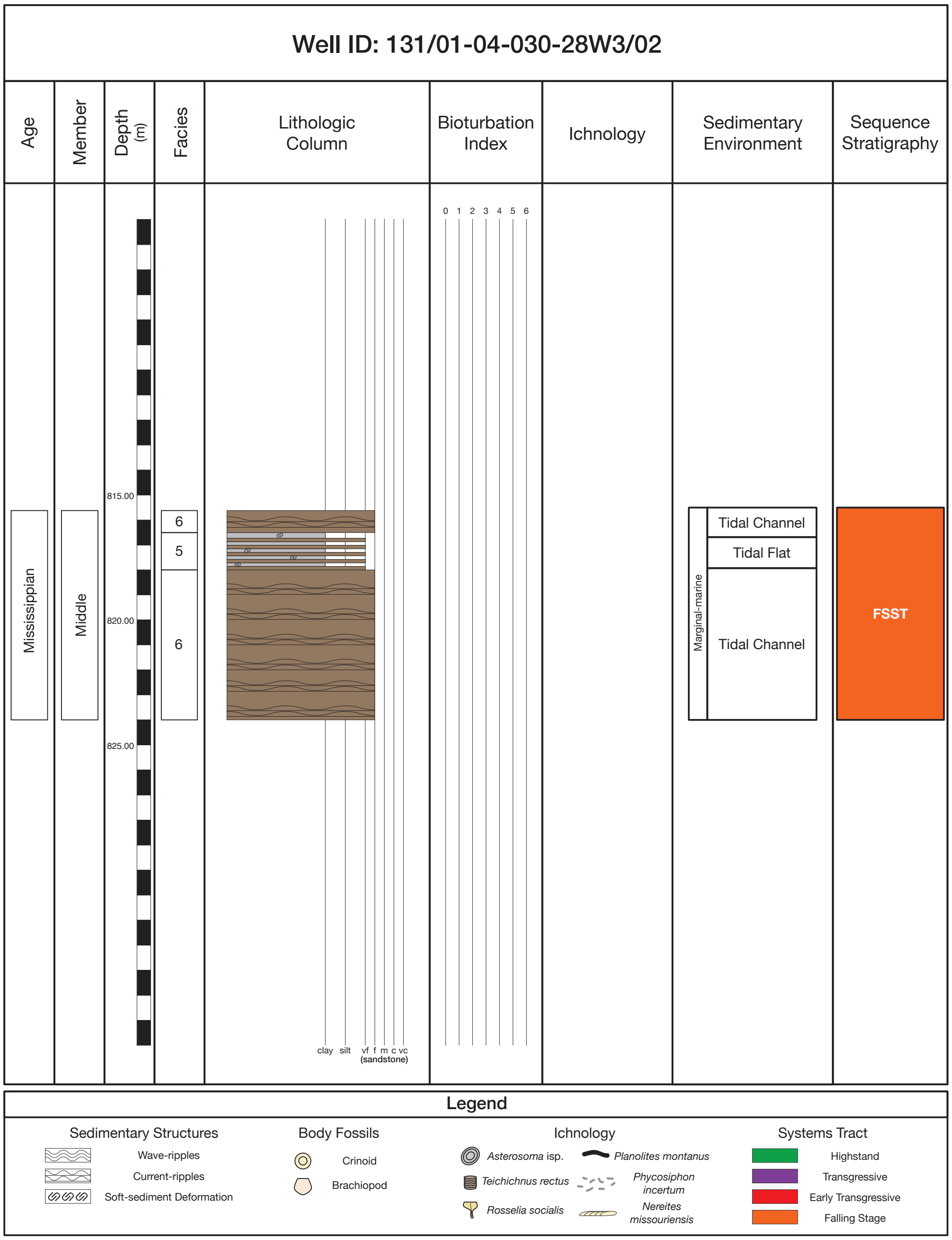
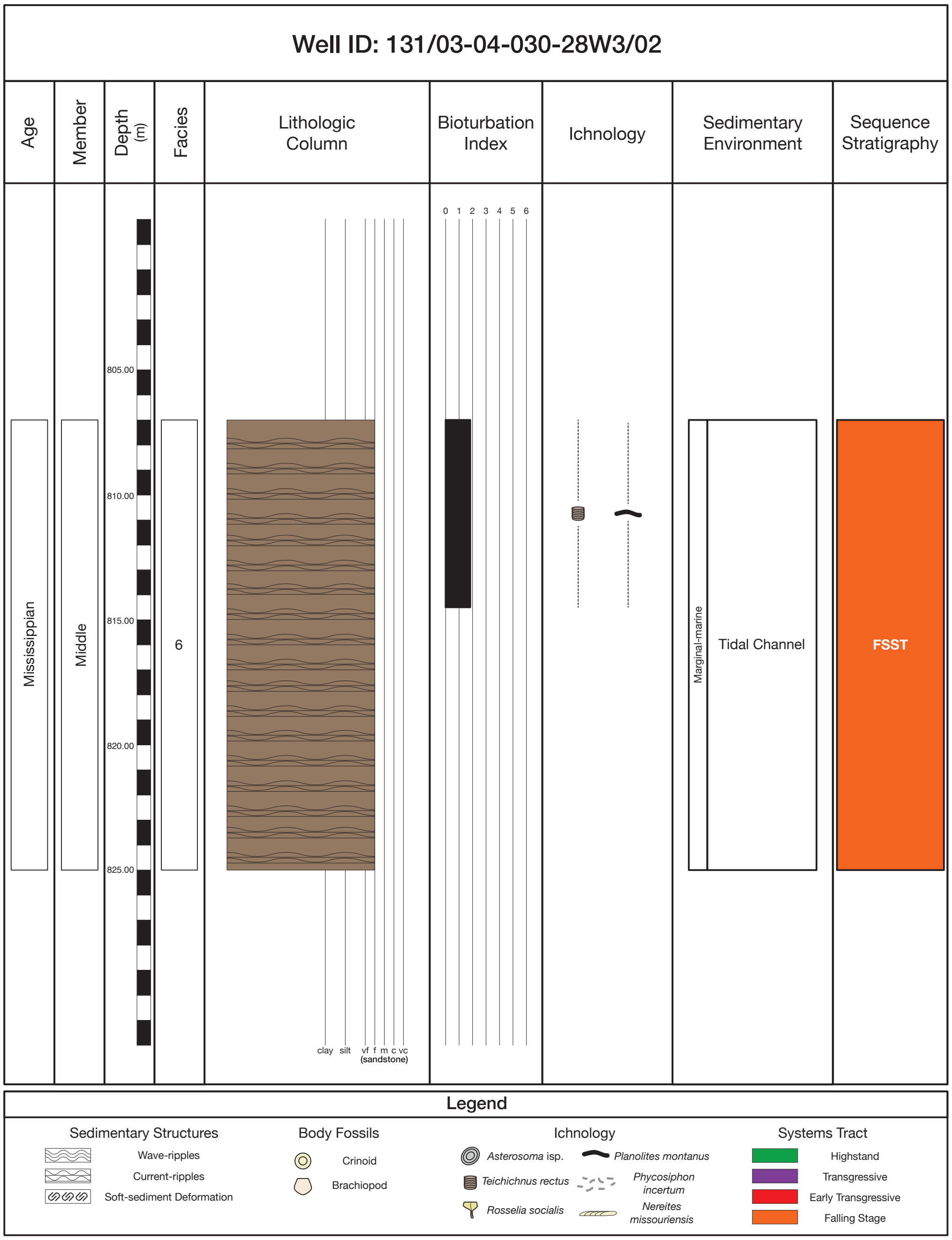
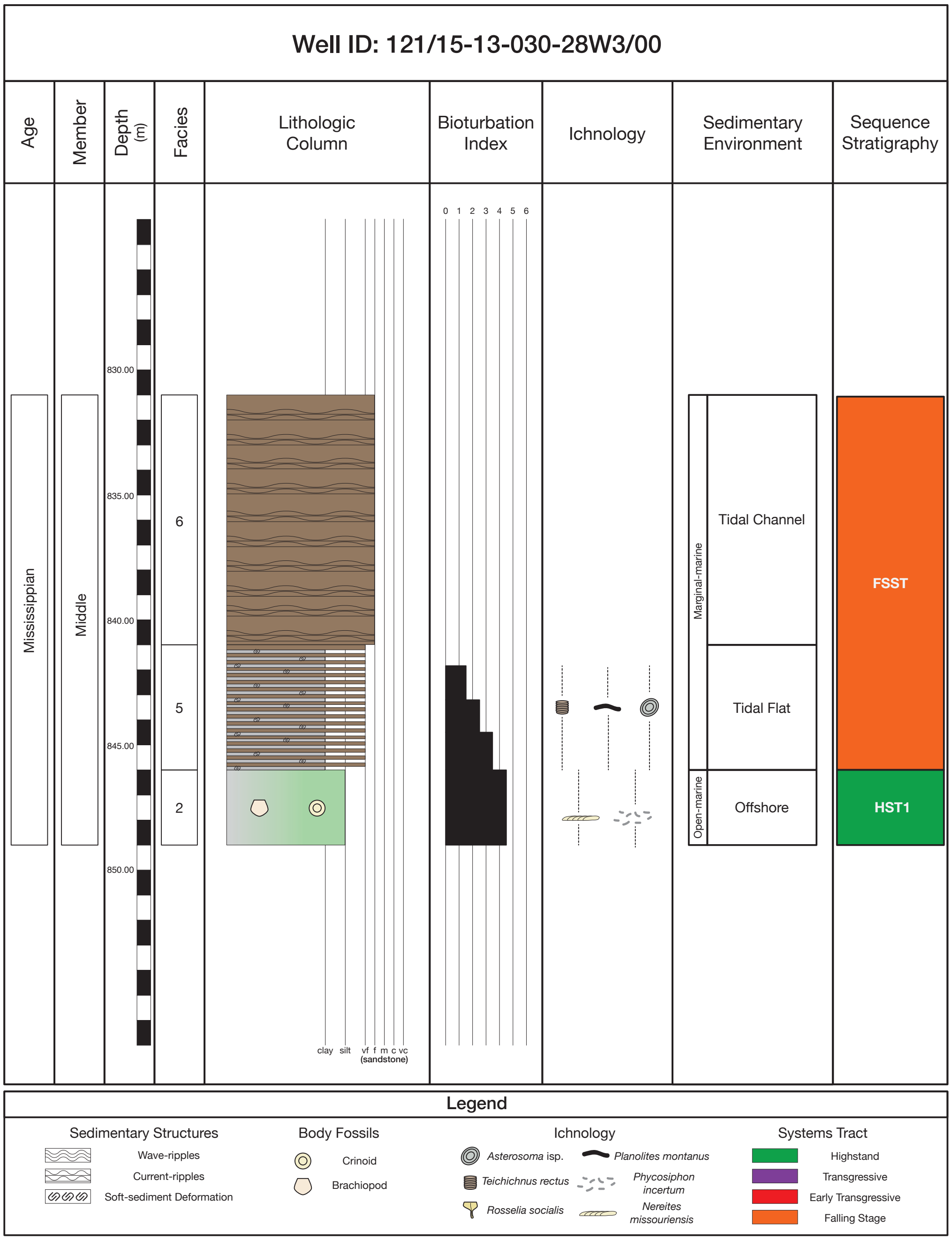
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Devonian
Middle
Lower
855.00
860.00
865.00
870.00
875.00
2
1
Big Valley Formation
0 1 2 3 4 5 6
clay silt vf f m c vc (sandstone)
Open-marine
Offshore
Shelf
HST1
TST1
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage



Well ID: 131/01-04-030-28W3/02
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
0 1 2 3 4 5 6
815.00
820.00
825.00
Mississippian
Middle
6
5
6
clay silt vf f m c vc (sandstone)
Marginal-marine
Tidal Channel
Tidal Flat
Tidal Channel
FSST
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Teichichnus rectus
Rosselia socialis
Planolites montanus
Phycosiphon incertum
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage



Well ID: 131/03-04-030-28W3/02
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
805.00
810.00
815.00
820.00
825.00
Mississippian
Middle
6
0 1 2 3 4 5 6
clay silt vf f m c vc (sandstone)
Marginal-marine
Tidal Channel
FSST
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage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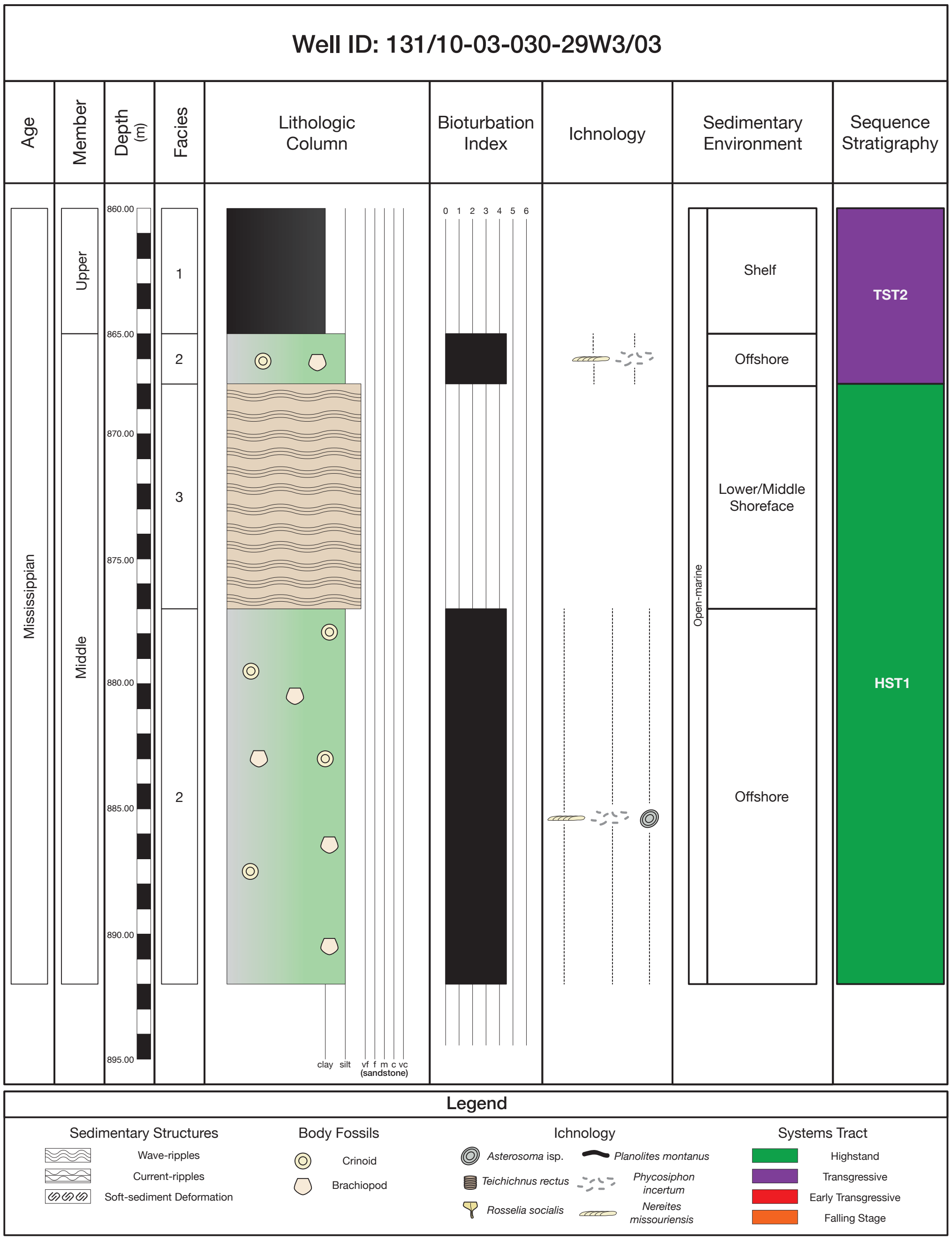
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Middle
830.00
835.00
840.00
845.00
850.00
6
5
2
clay silt vf f m c vc (sandstone)
0 1 2 3 4 5 6
Marginal-marine
Open-marine
Tidal Channel
Tidal Flat
Offshore
FSST
HST1
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Teichichnus rectus
Rosselia socialis
Planolites montanus
Phycosiphon incertum
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage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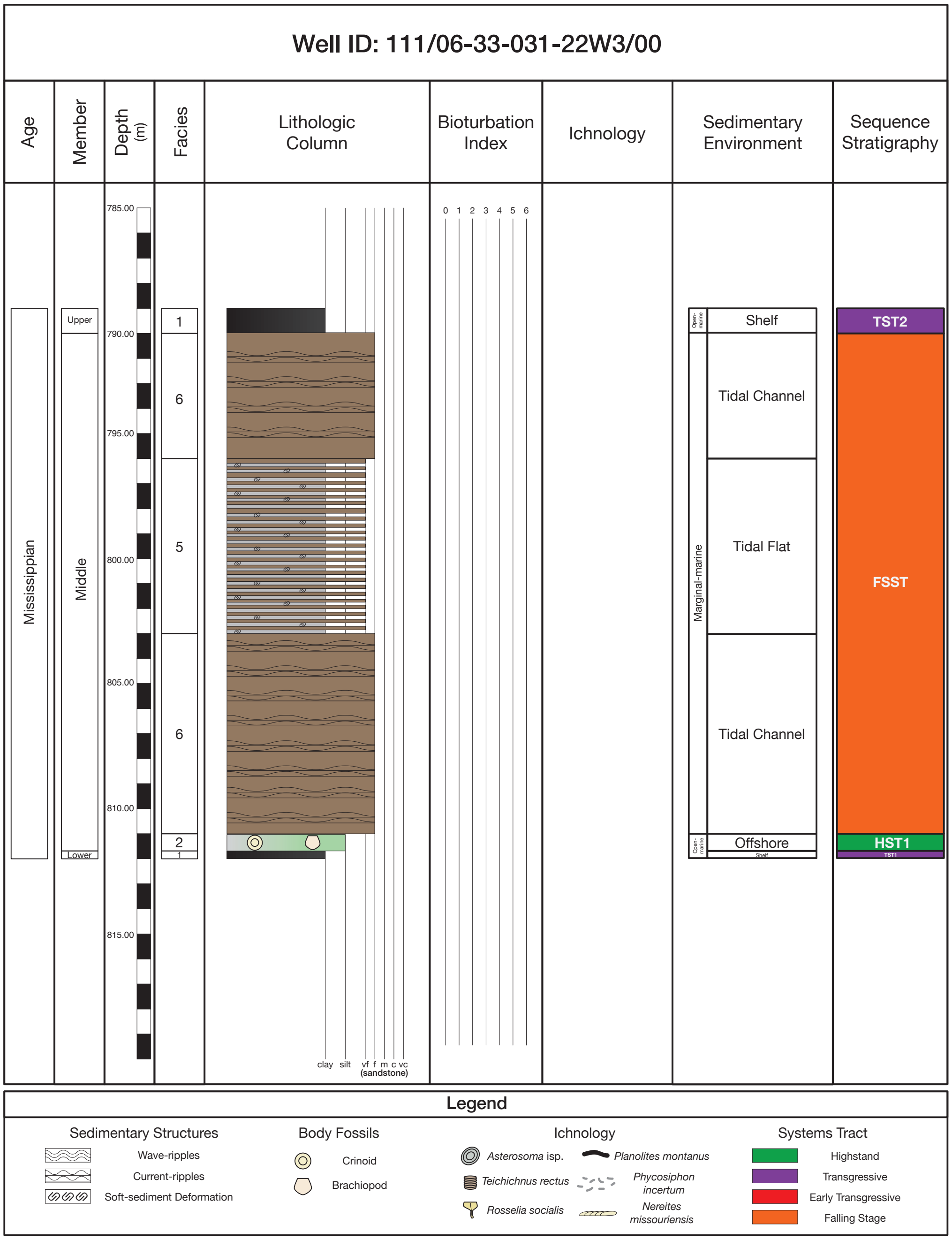
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Upper
Middle
860.00
865.00
870.00
875.00
880.00
885.00
890.00
895.00
1
2
3
2
clay silt vf f m c vc (sandstone)
0 1 2 3 4 5 6
Open-marine
Shelf
Offshore
Lower/Middle Shoreface
Offshore
TST2
HST1
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Teichichnus rectus
Rosselia socialis
Planolites montanus
Phycosiphon incertum
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage



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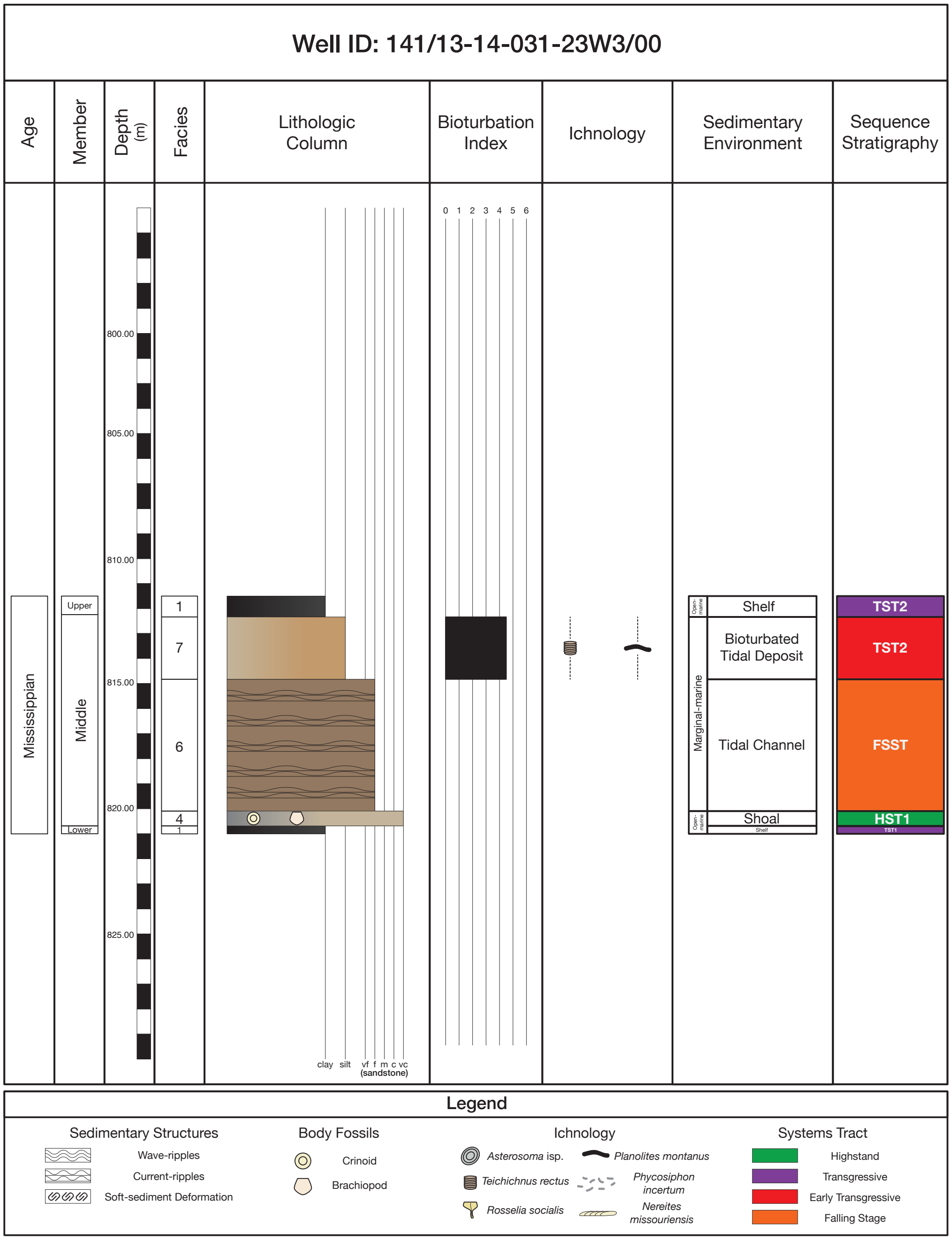
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Upper
Middle
Lower
785.00
790.00
795.00
800.00
805.00
810.00
815.00
1
6
5
6
2
1
clay silt vf f m c vc (sandstone)
0 1 2 3 4 5 6
Marginal-marine
Shelf
Tidal Channel
Tidal Flat
Tidal Channel
Offshore
Shelf
TST2
FSST
HST1
TST1
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Teichichnus rectus
Rosselia socialis
Planolites montanus
Phycosiphon incertum
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage



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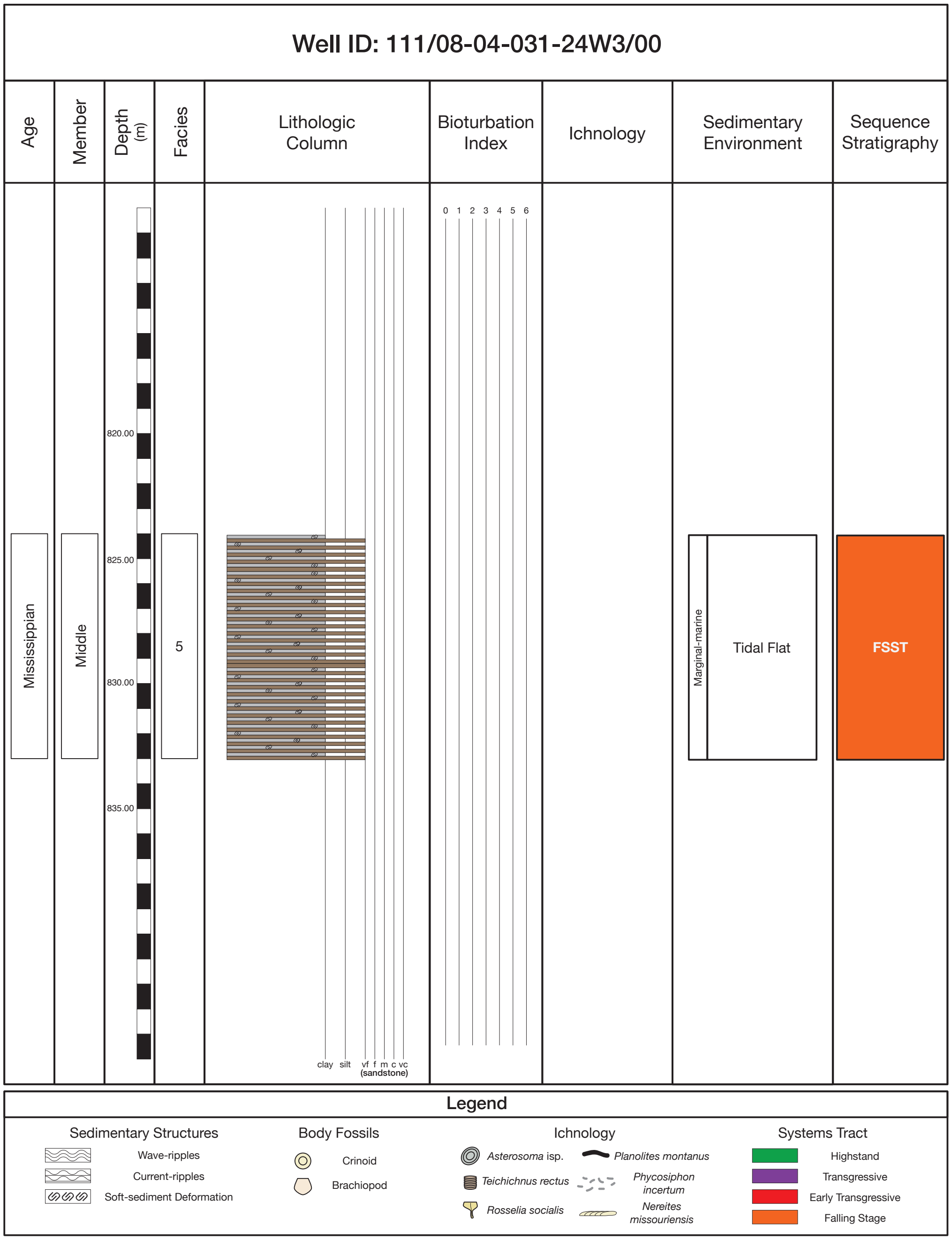
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Upper
Middle
Lower
800.00
805.00
810.00
815.00
820.00
825.00
1
7
6
4
1
clay silt vf f m c vc (sandstone)
0 1 2 3 4 5 6
Shelf
Bioturbated Tidal Deposit
Tidal Channel
Shoal
Marginal-marine
TST2
TST2
FSST
HST1
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage



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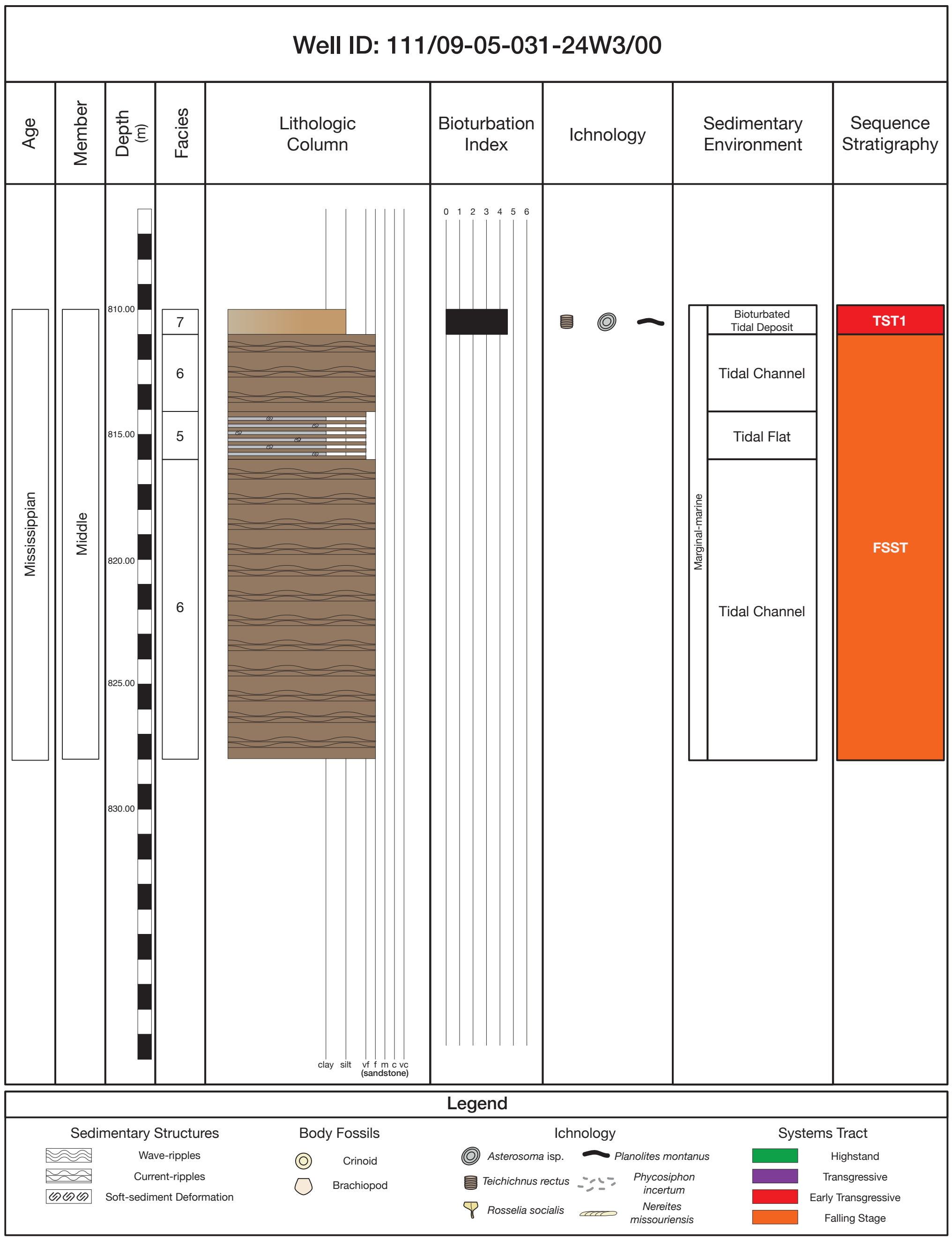
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
0 1 2 3 4 5 6
820.00
825.00
830.00
835.00
Mississippian
Middle
5
clay silt vf f m c vc (sandstone)
Marginal-marine
Tidal Flat
FSST
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage



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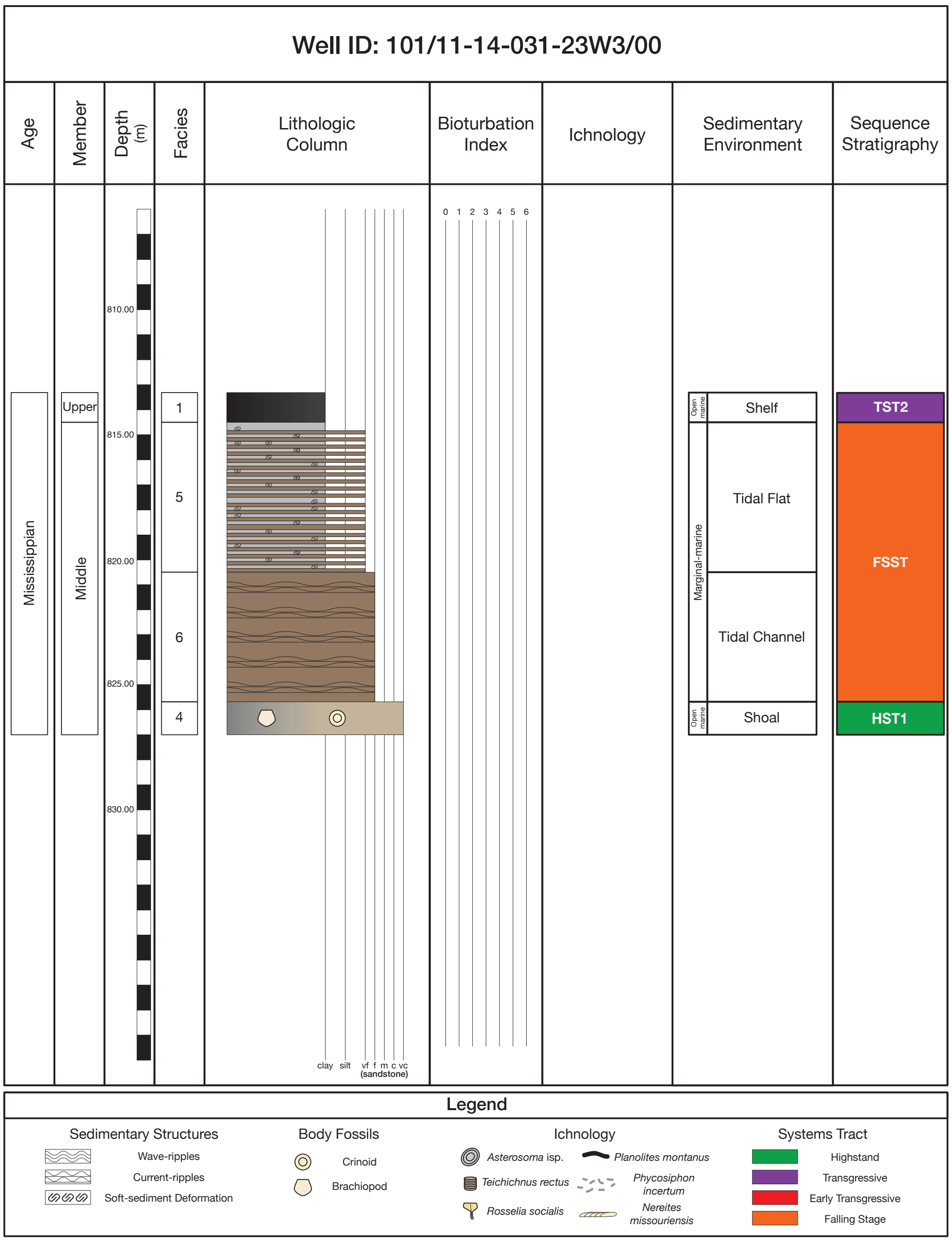
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Middle
810.00
815.00
820.00
825.00
830.00
7
6
5
6
clay silt vf f m c vc (sandstone)
0 1 2 3 4 5 6
Marginal-marine
Bioturbated Tidal Deposit
Tidal Channel
Tidal Flat
Tidal Channel
TST1
FSST
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage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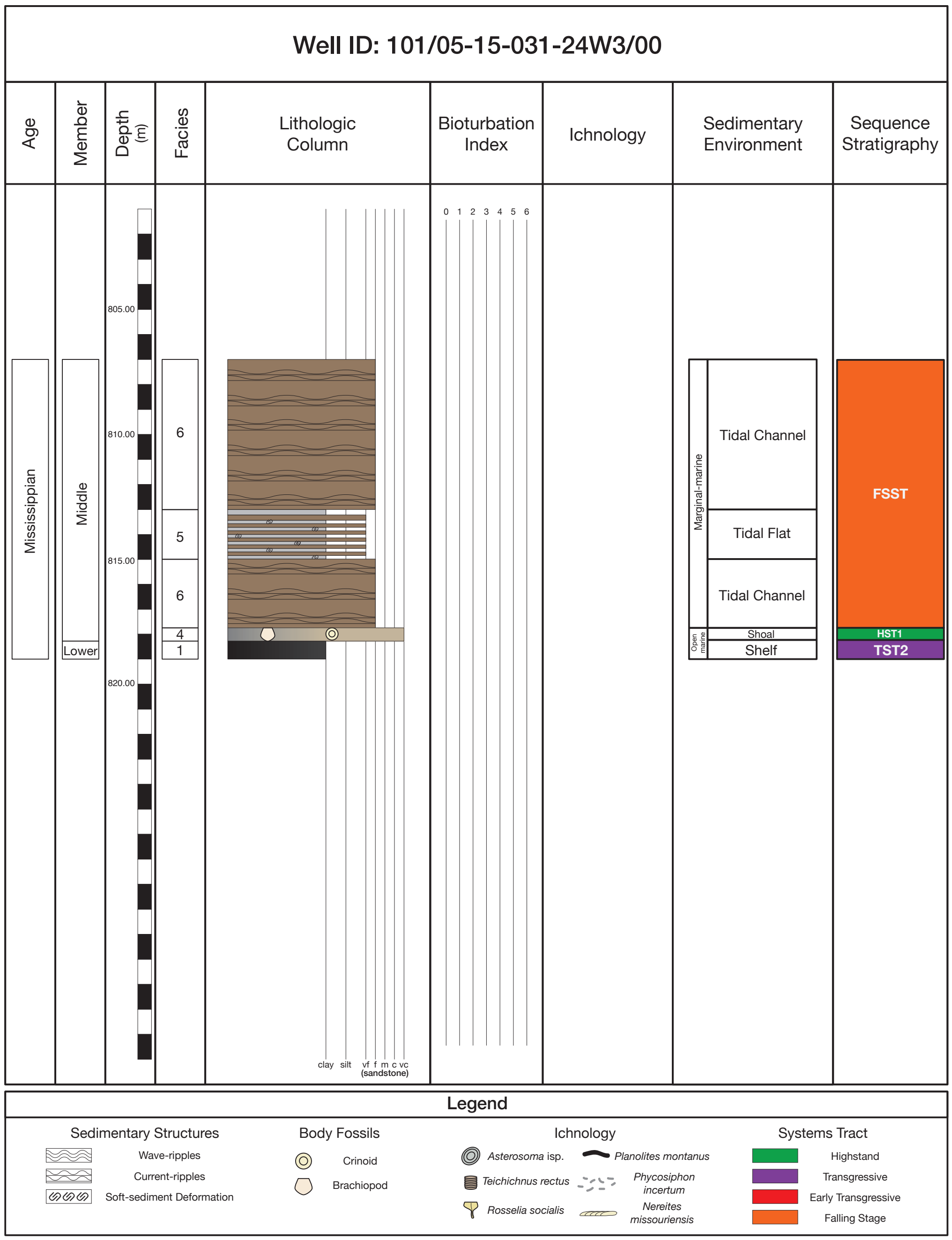
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Upper
Middle
810.00
815.00
820.00
825.00
830.00
1
5
6
4
0 1 2 3 4 5 6
clay silt vf f m c vc (sandstone)
Open marine
Marginal-marine
Shelf
Tidal Flat
Tidal Channel
Shoal
TST2
FSST
HST1
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Teichichnus rectus
Rosselia socialis
Planolites montanus
Phycosiphon incertum
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage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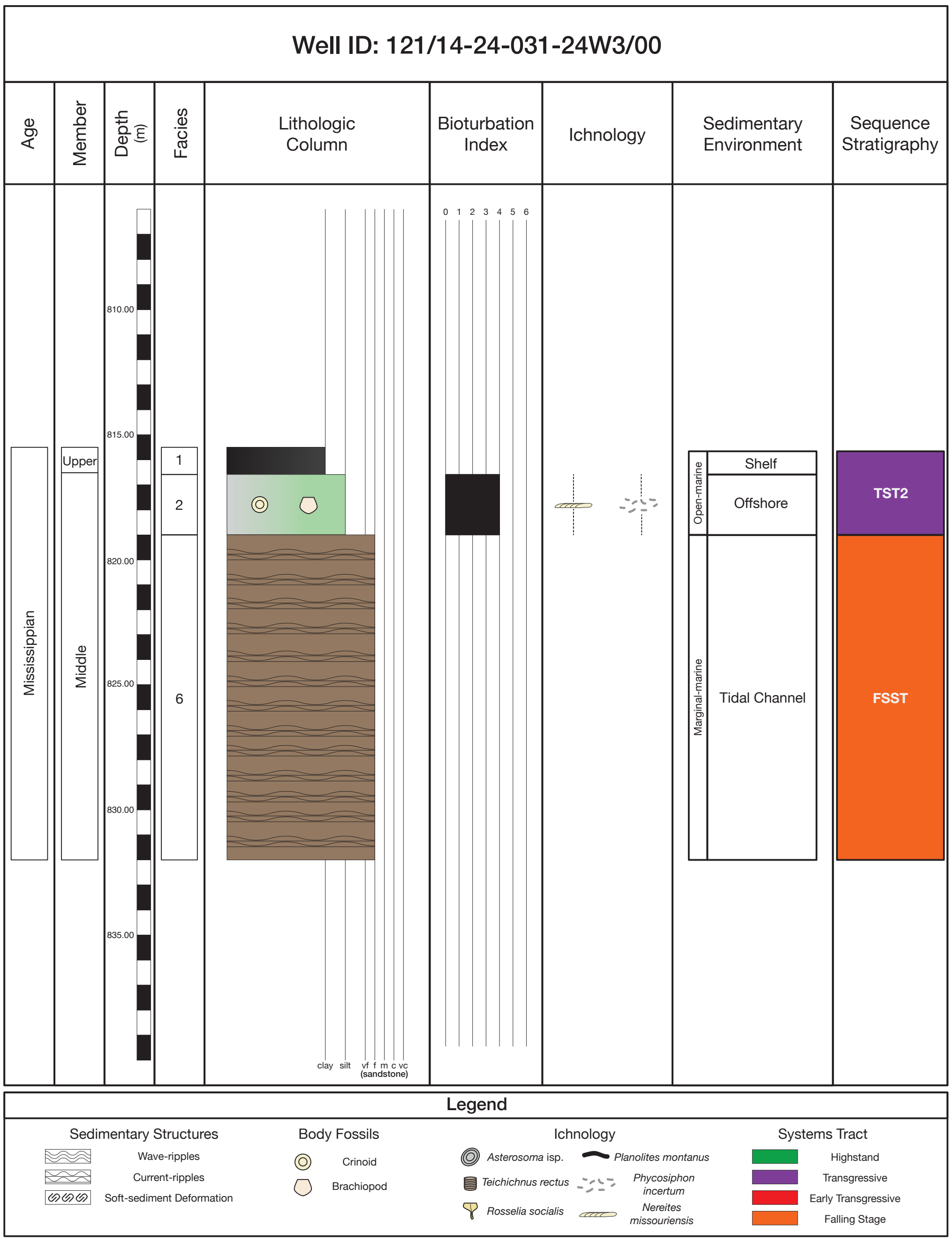
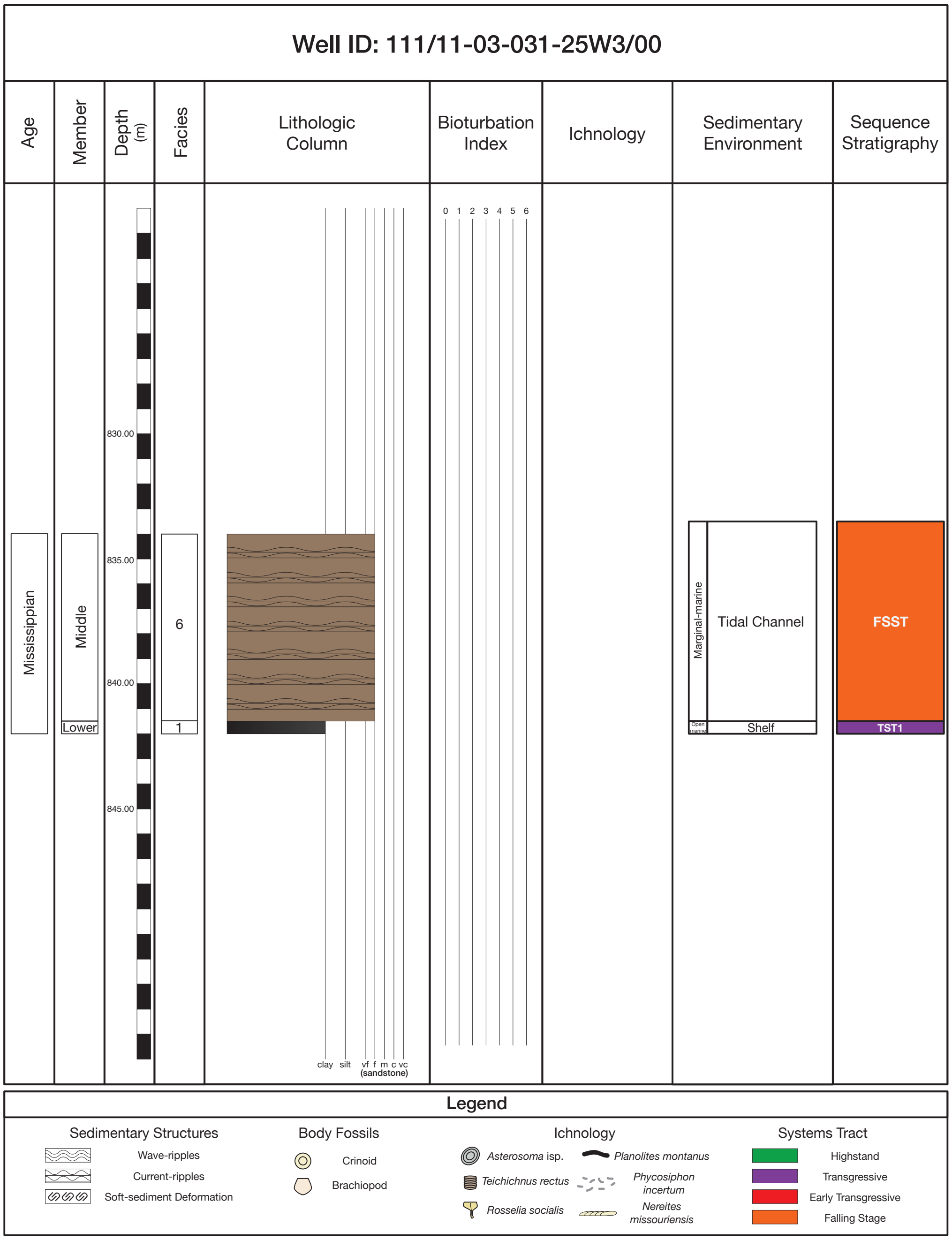
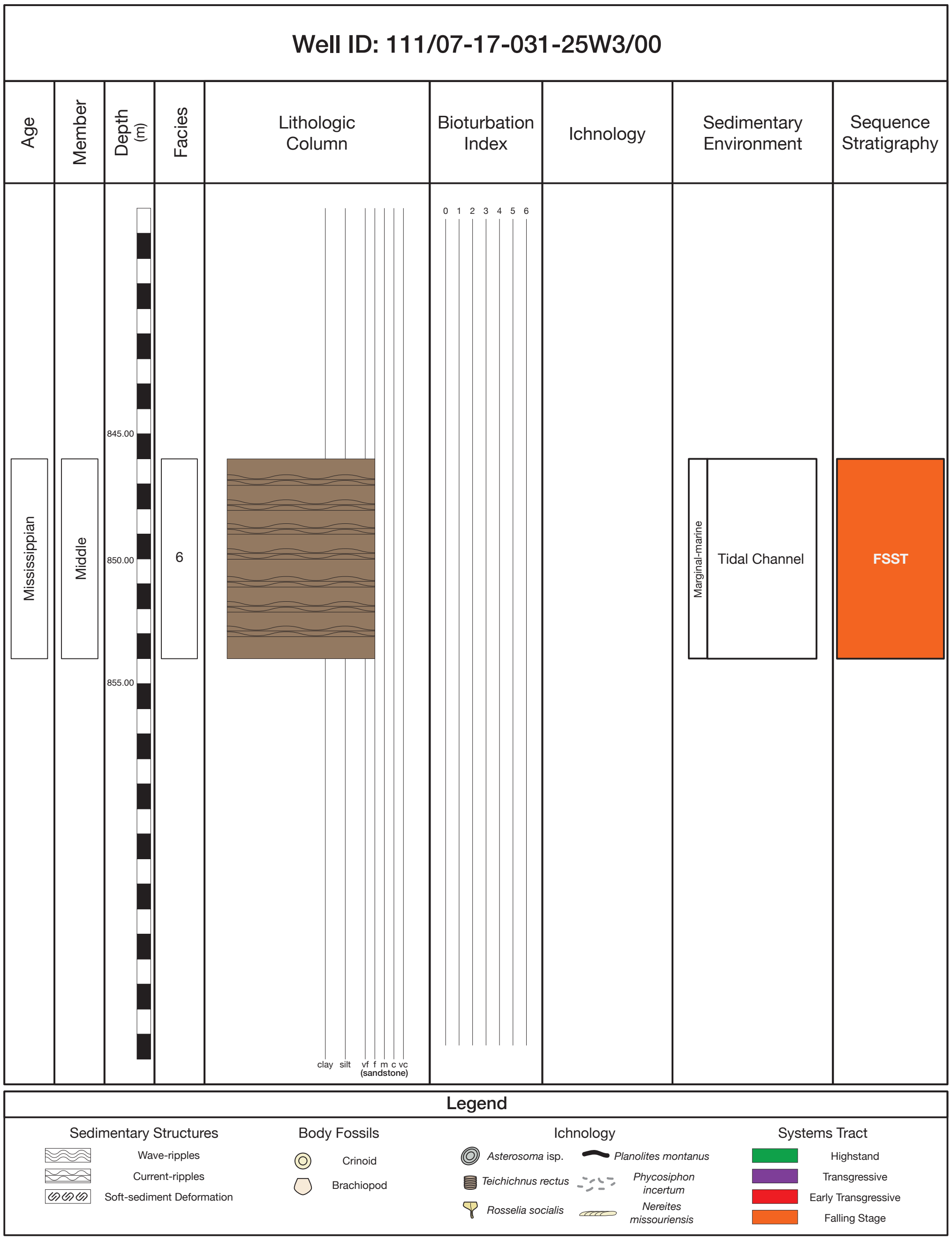
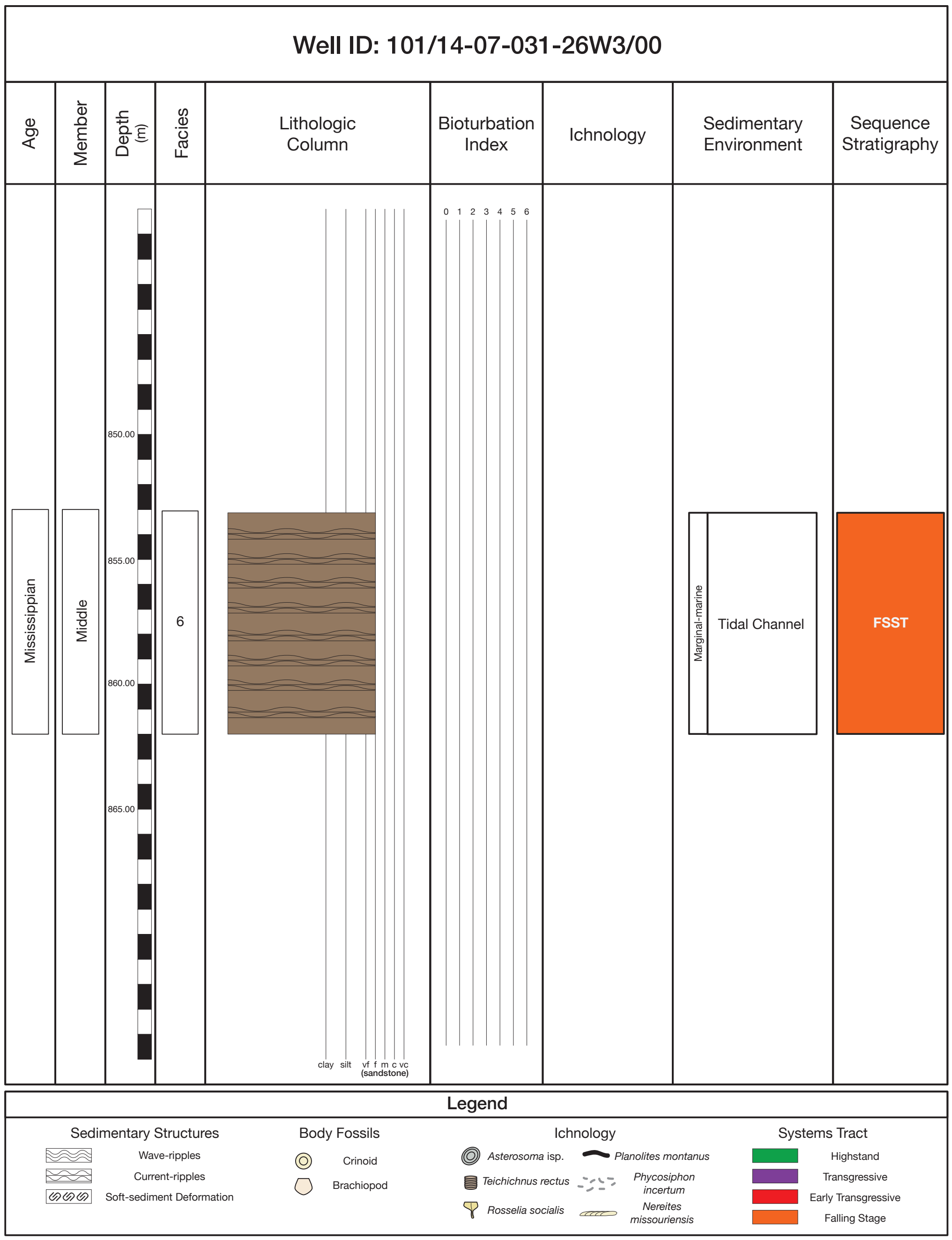
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
0 1 2 3 4 5 6
805.00
810.00
815.00
820.00
Mississippian
Middle
Lower
6
5
6
4
1
clay silt vf f m c vc (sandstone)
Marginal-marine
Open marine
Tidal Channel
Tidal Flat
Tidal Channel
Shoal
Shelf
FSST
HST1
TST2
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage


Well ID: 121/14-24-031-24W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Upper
Middle
810.00
815.00
820.00
825.00
830.00
835.00
1
2
6
clay silt vf f m c vc (sandstone)
0 1 2 3 4 5 6
Open-marine
Marginal-marine
Shelf
Offshore
Tidal Channel
TST2
FSST
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Teichichnus rectus
Rosselia socialis
Planolites montanus
Phycosiphon incertum
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage


Well ID: 111/11-03-031-25W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
830.00
835.00
840.00
845.00
Mississippian
Middle
Lower
6
1
0 1 2 3 4 5 6
clay silt vf f m c vc (sandstone)
Marginal-marine
Tidal Channel
Open marine
Shelf
FSST
TST1
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Teichichnus rectus
Rosselia socialis
Planolites montanus
Phycosiphon incertum
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage



Well ID: 111/07-17-031-25W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
0 1 2 3 4 5 6
845.00
850.00
855.00
Mississippian
Middle
6
Marginal-marine
Tidal Channel
FSST
clay silt vf f m c vc (sandstone)
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage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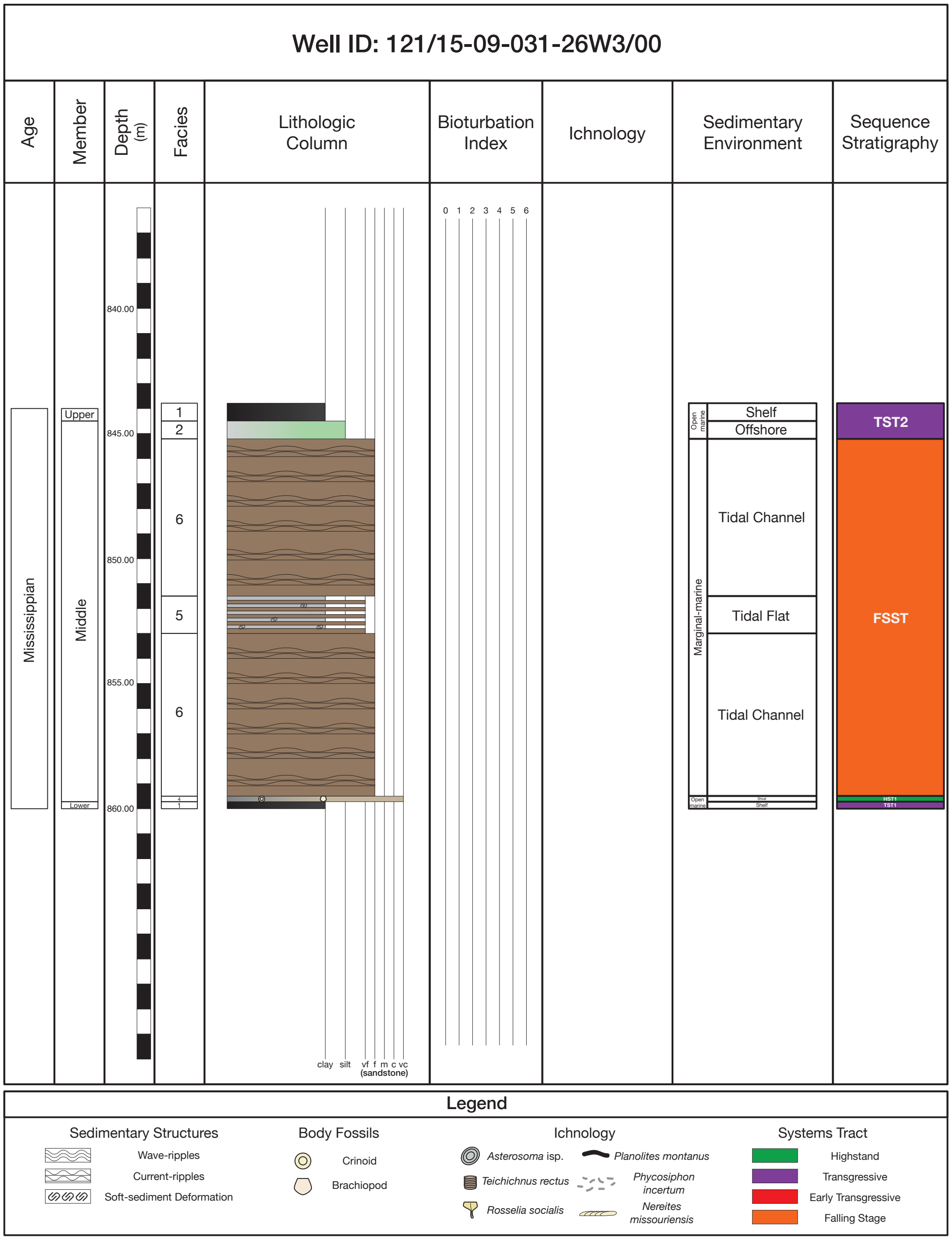
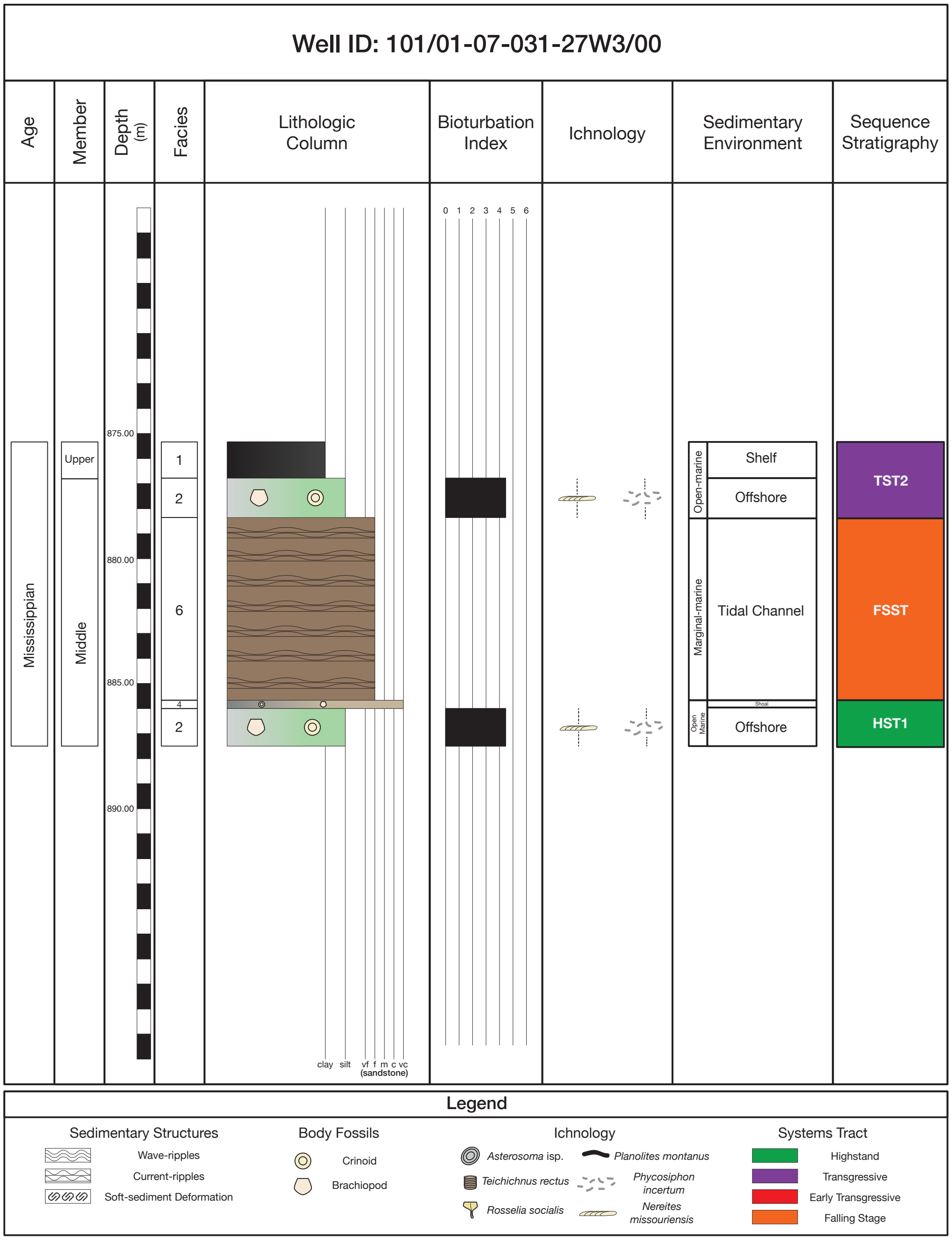
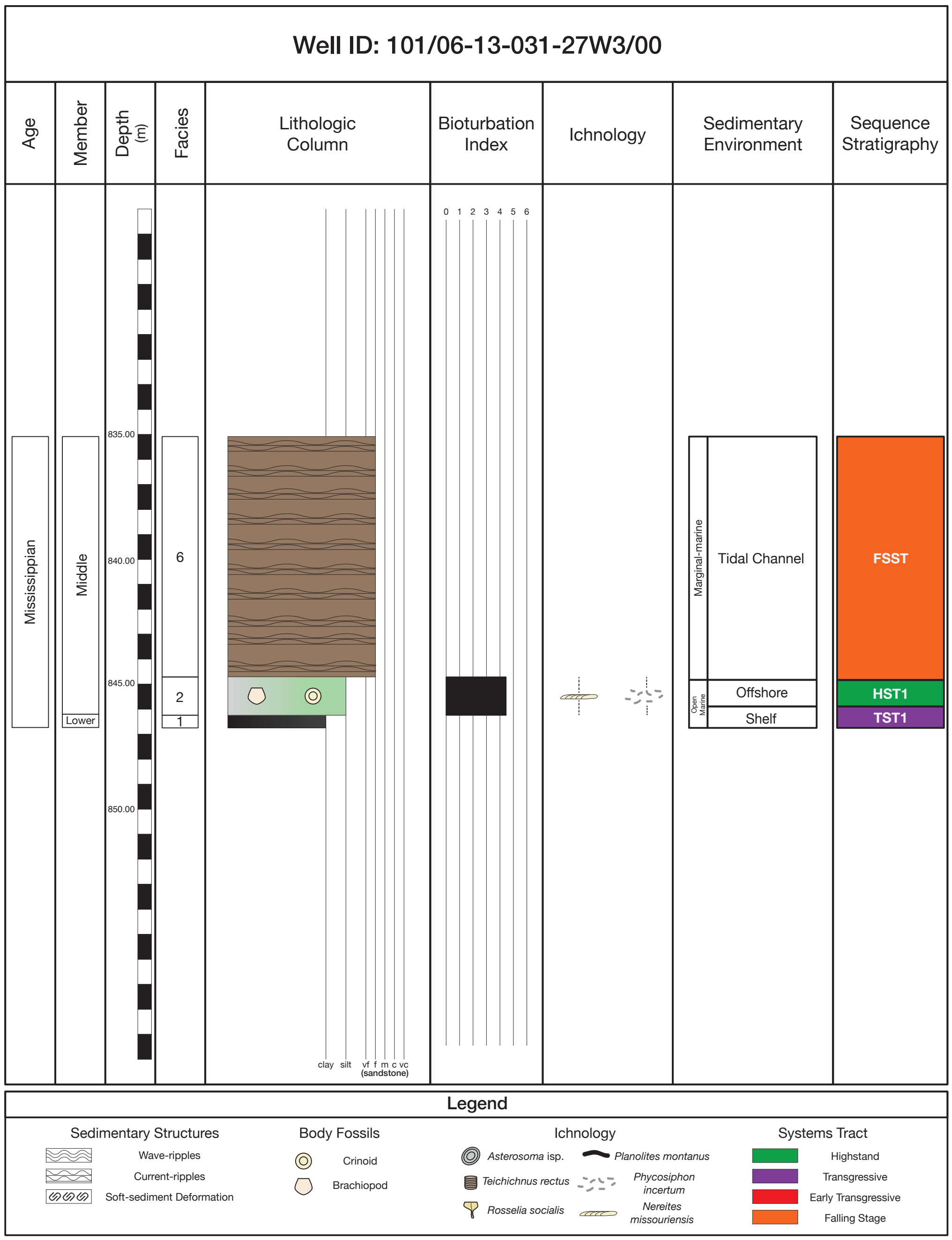
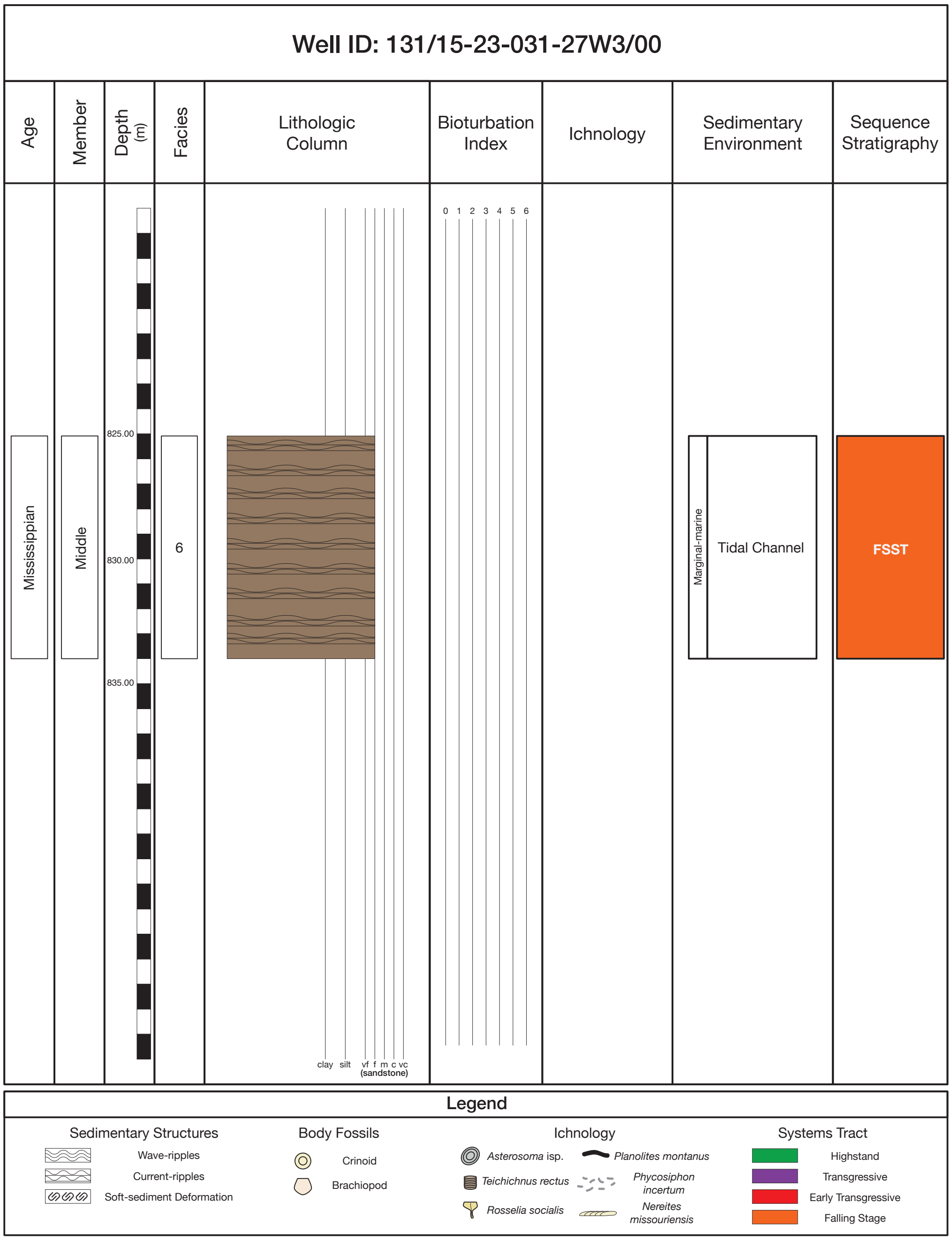
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
0 1 2 3 4 5 6
850.00
855.00
860.00
865.00
Mississippian
Middle
6
Marginal-marine
Tidal Channel
FSST
clay silt vf f m c vc
(sandstone)
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage

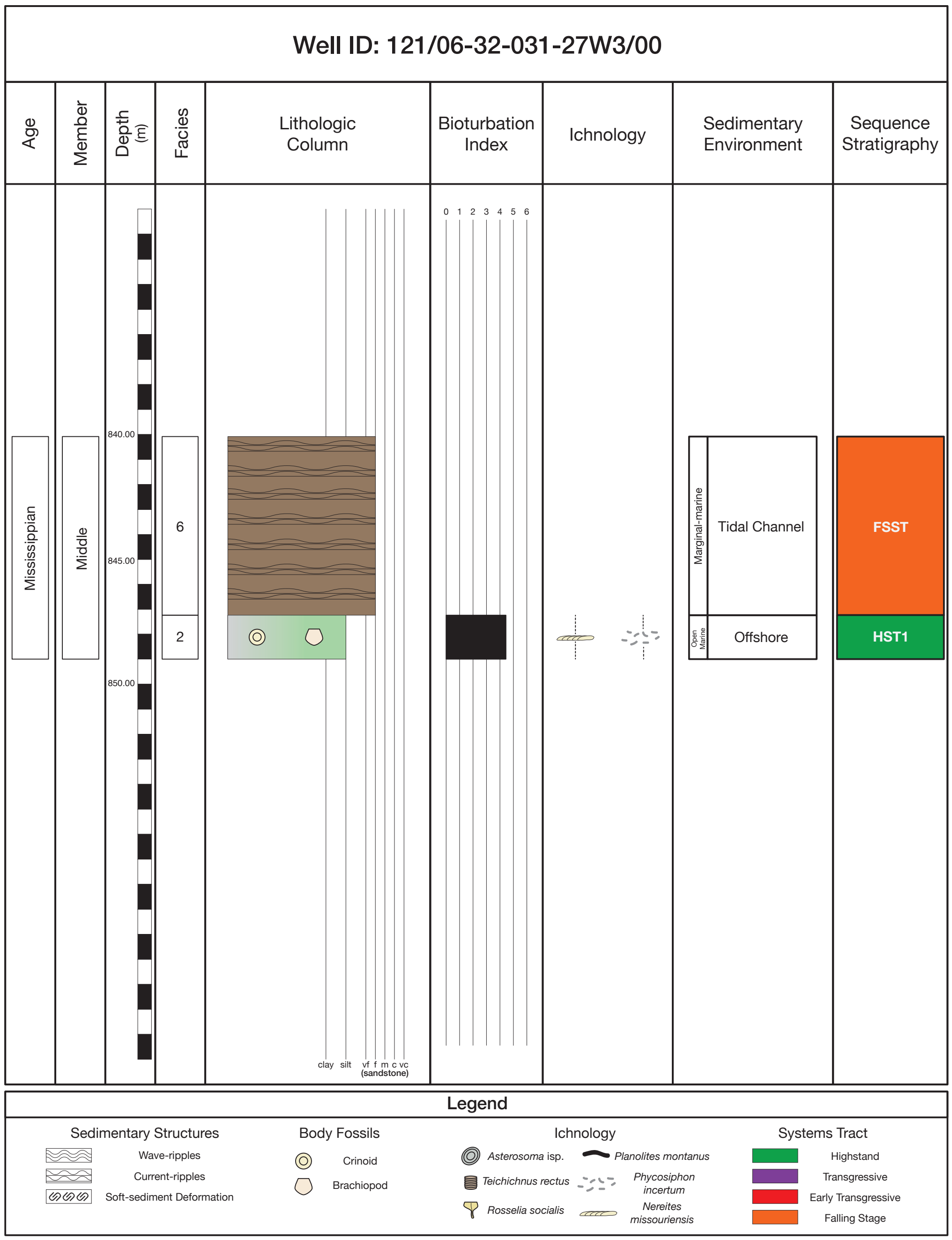

Well ID: 121/15-09-031-26W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Upper
Middle
Lower
840.00
845.00
850.00
855.00
860.00
1
2
6
5
6
0 1 2 3 4 5 6
clay silt vf f m c vc
(sandstone)
Open marine
Shelf
Offshore
Marginal-marine
Tidal Channel
Tidal Flat
Tidal Channel
TST2
FSST
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage


Well ID: 101/01-07-031-27W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Upper
Middle
875.00
880.00
885.00
890.00
1
2
6
4
2
0 1 2 3 4 5 6
clay silt vf f m c vc (sandstone)
Open-marine
Marginal-marine
Open Marine
Shelf
Offshore
Tidal Channel
Shoal
Offshore
TST2
FSST
HST1
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage

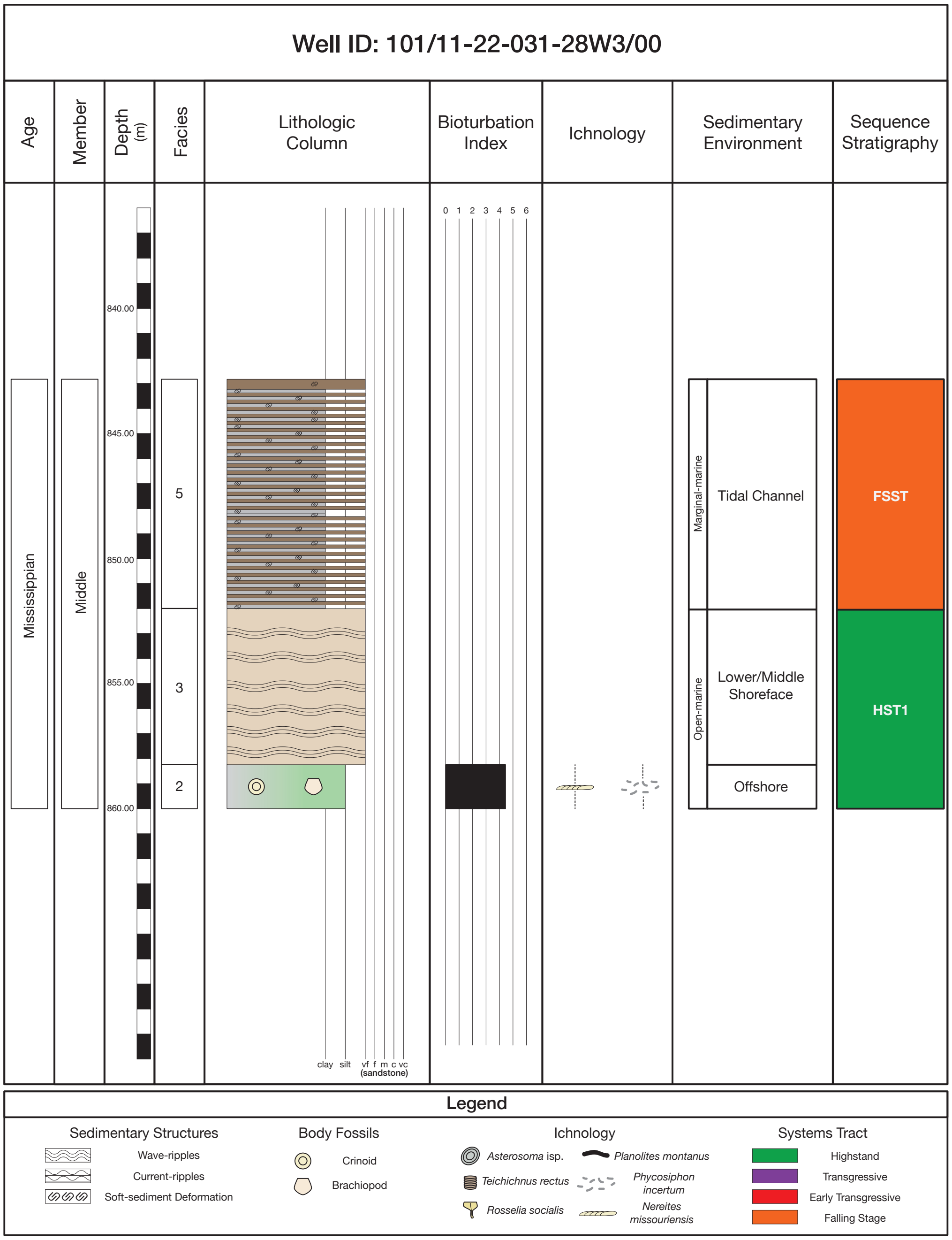

Well ID: 101/06-13-031-27W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Middle
Lower
835.00
840.00
845.00
850.00
6
2
1
0 1 2 3 4 5 6
clay silt vf f m c vc (sandstone)
Marginal-marine
Open Marine
Tidal Channel
Offshore
Shelf
FSST
HST1
TST1
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage

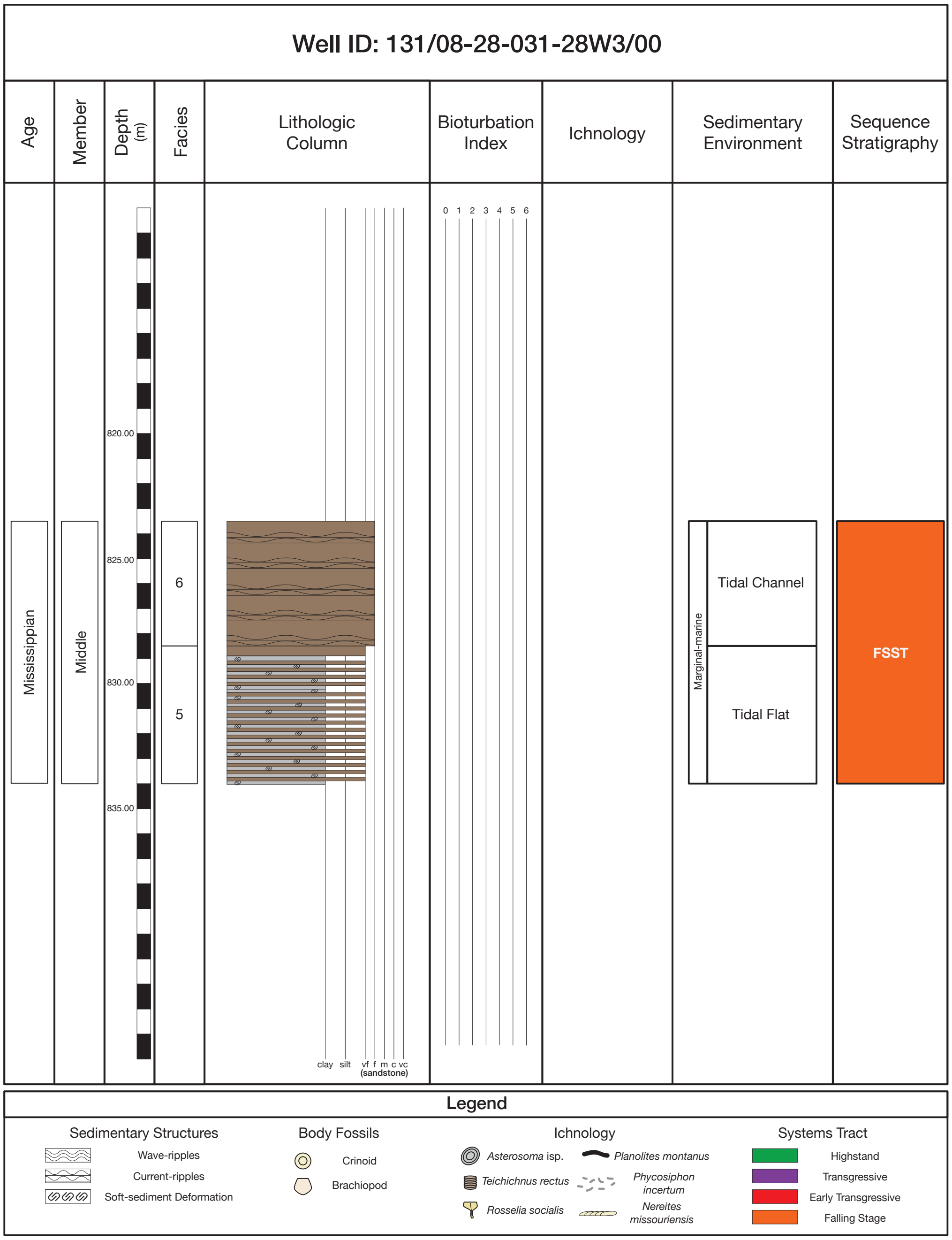


Well ID: 131/15-23-031-27W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
0 1 2 3 4 5 6
825.00
830.00
835.00
Mississippian
Middle
6
Marginal-marine
Tidal Channel
FSST
clay silt vf f m c vc (sandstone)
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage

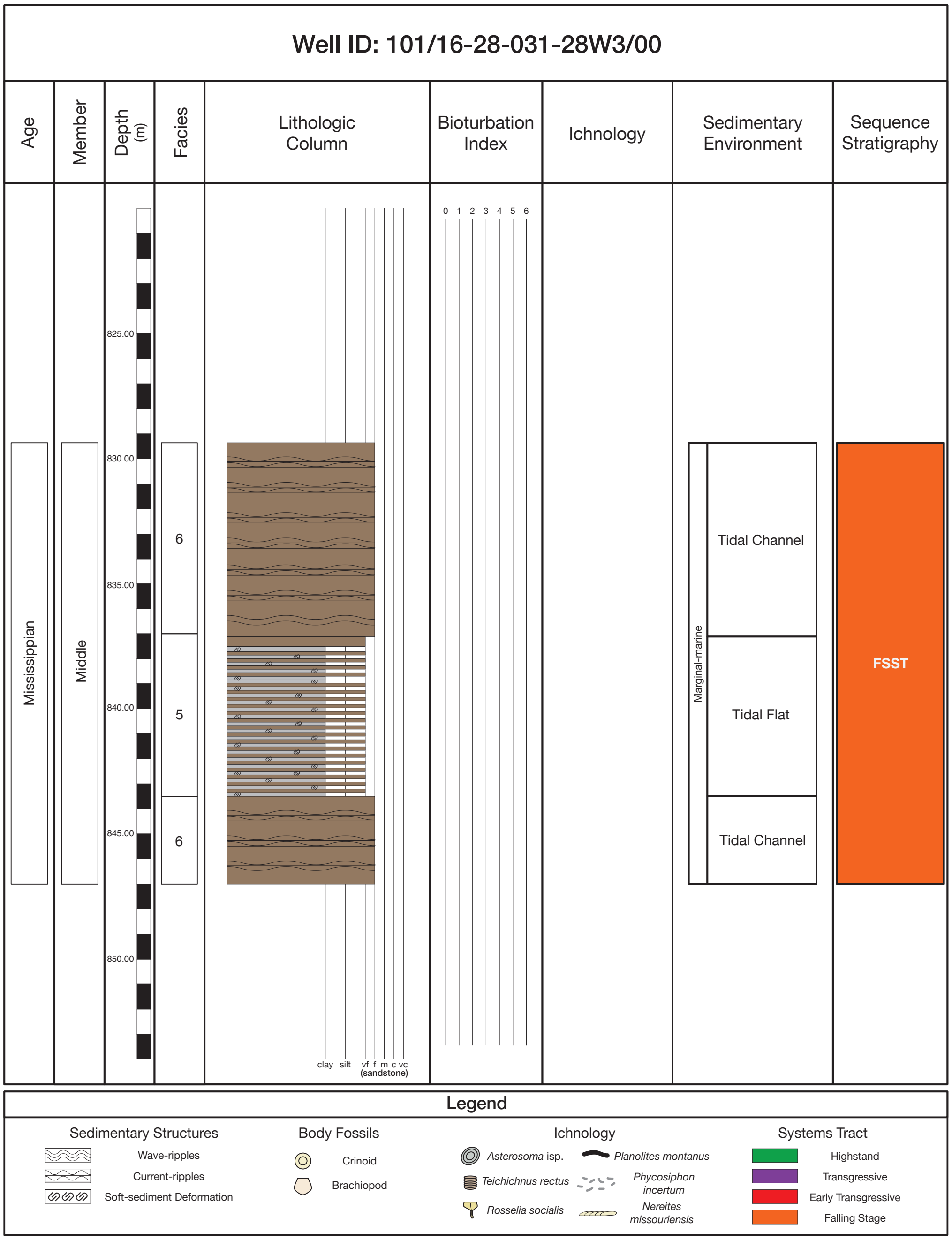


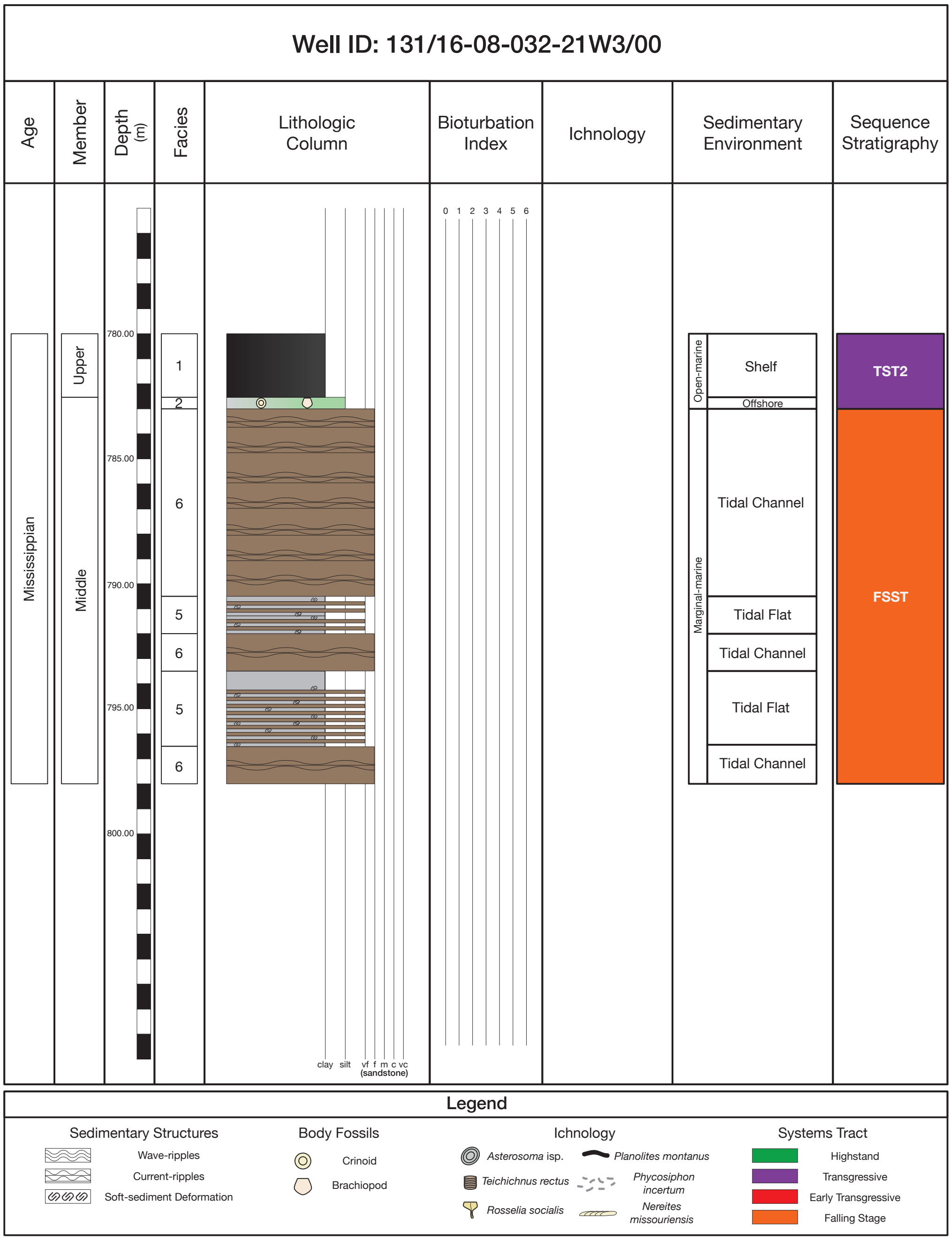
Well ID: 121/06-32-031-27W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Middle
840.00
845.00
850.00
6
2
0 1 2 3 4 5 6
clay silt vf f m c vc (sandstone)
Marginal-marine
Open Marine
Tidal Channel
Offshore
FSST
HST1
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Teichichnus rectus
Rosselia socialis
Planolites montanus
Phycosiphon incertum
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage


Well ID: 101/11-22-031-28W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Middle
840.00
845.00
850.00
855.00
860.00
5
3
2
clay silt vf f m c vc (sandstone)
0 1 2 3 4 5 6
Marginal-marine
Open-marine
Tidal Channel
Lower/Middle Shoreface
Offshore
FSST
HST1
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage



Well ID: 131/08-28-031-28W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
0 1 2 3 4 5 6
820.00
825.00
830.00
835.00
Mississippian
Middle
6
5
clay silt vf f m c vc (sandstone)
Marginal-marine
Tidal Channel
Tidal Flat
FSST
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage


Well ID: 101/16-28-031-28W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Middle
825.00
830.00
835.00
840.00
845.00
850.00
6
5
6
0 1 2 3 4 5 6
clay silt vf f m c vc (sandstone)
Marginal-marine
Tidal Channel
Tidal Flat
Tidal Channel
FSST
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage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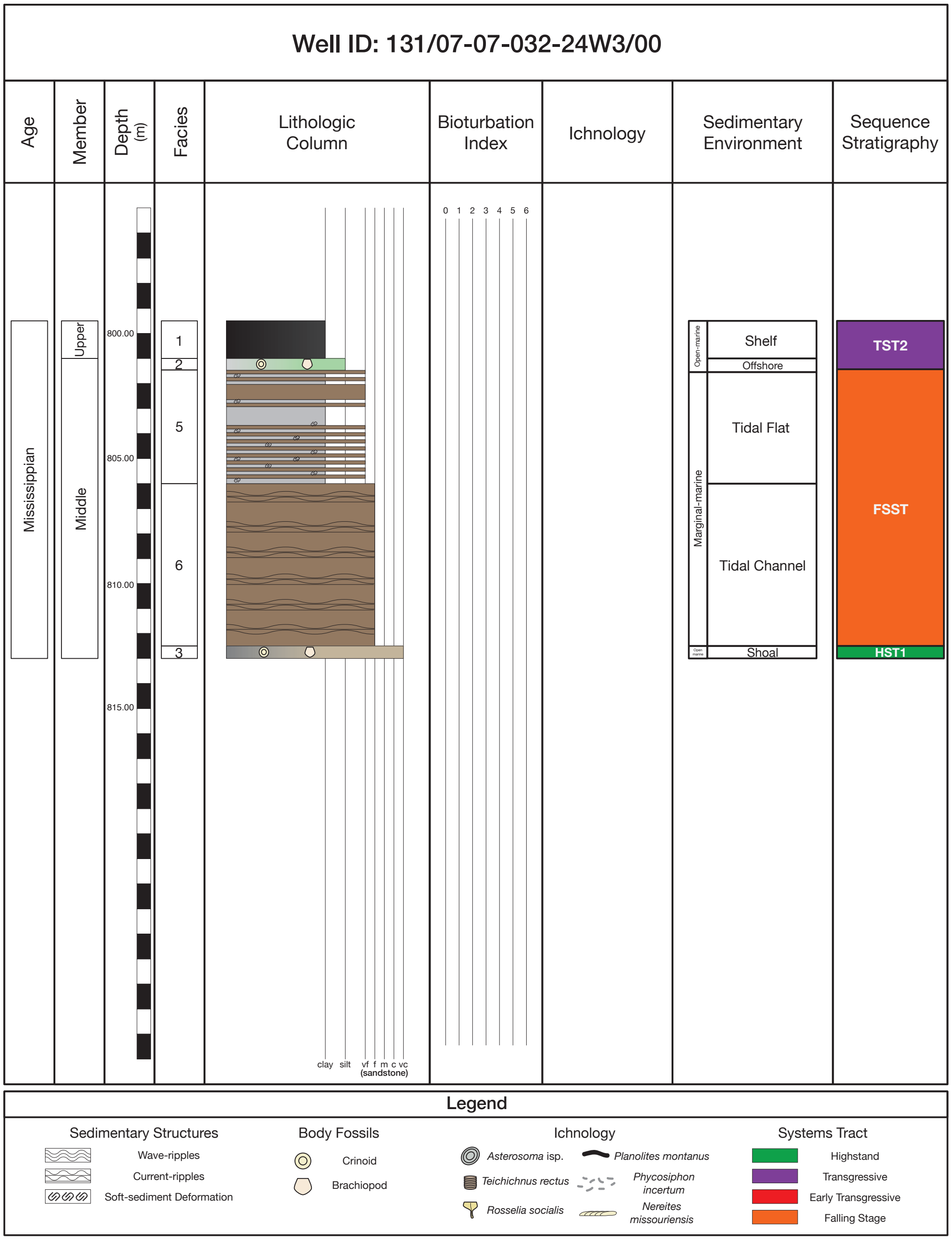
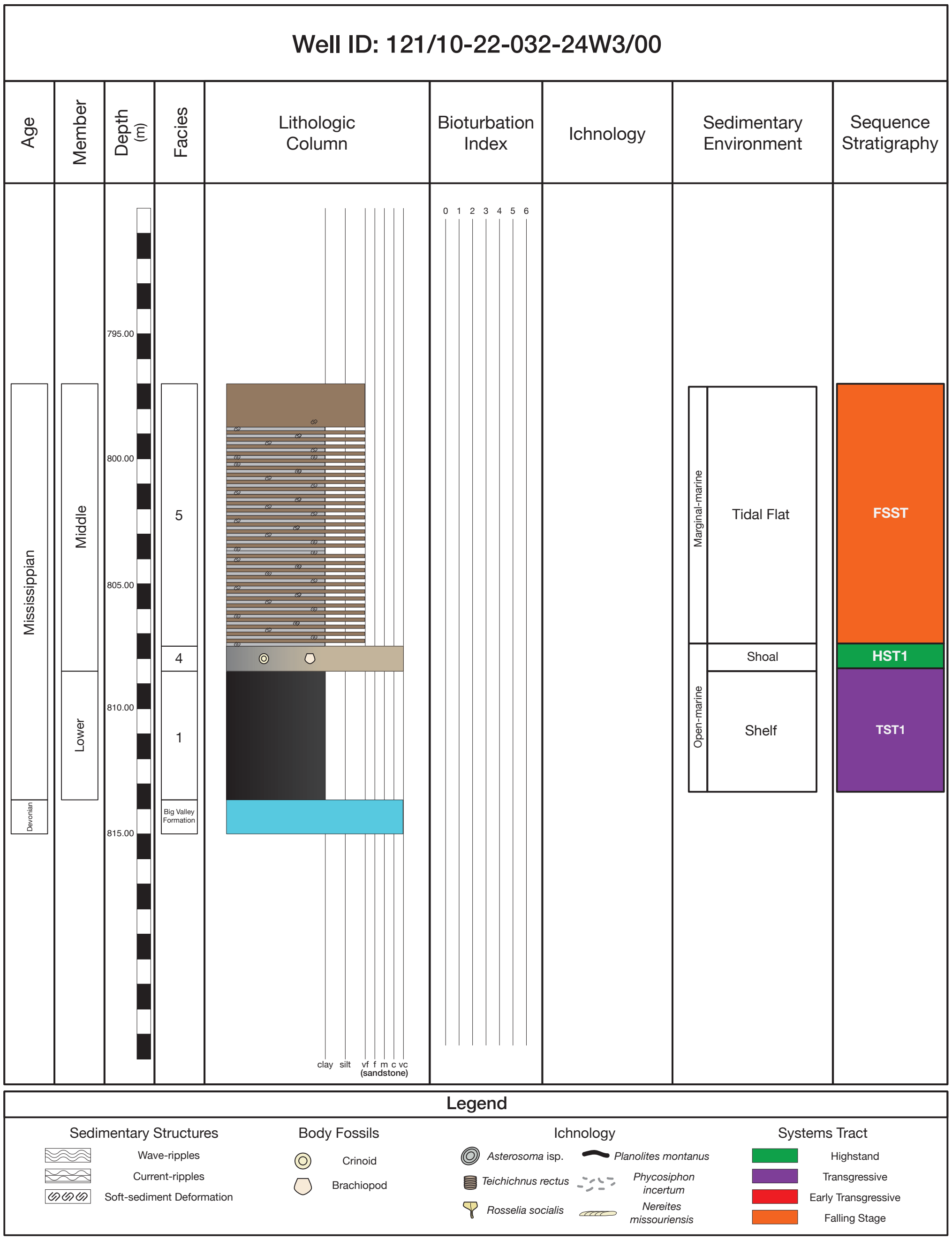
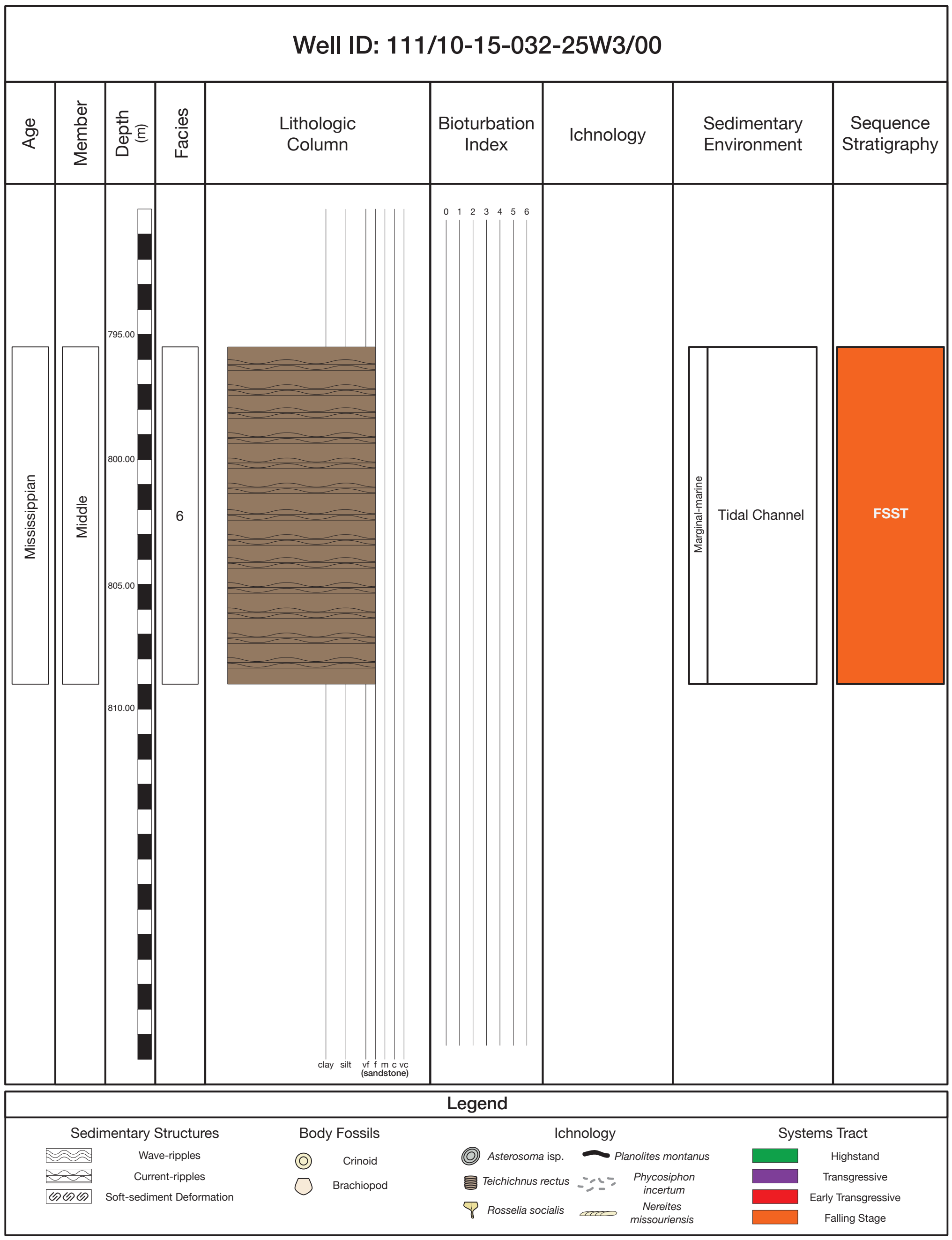
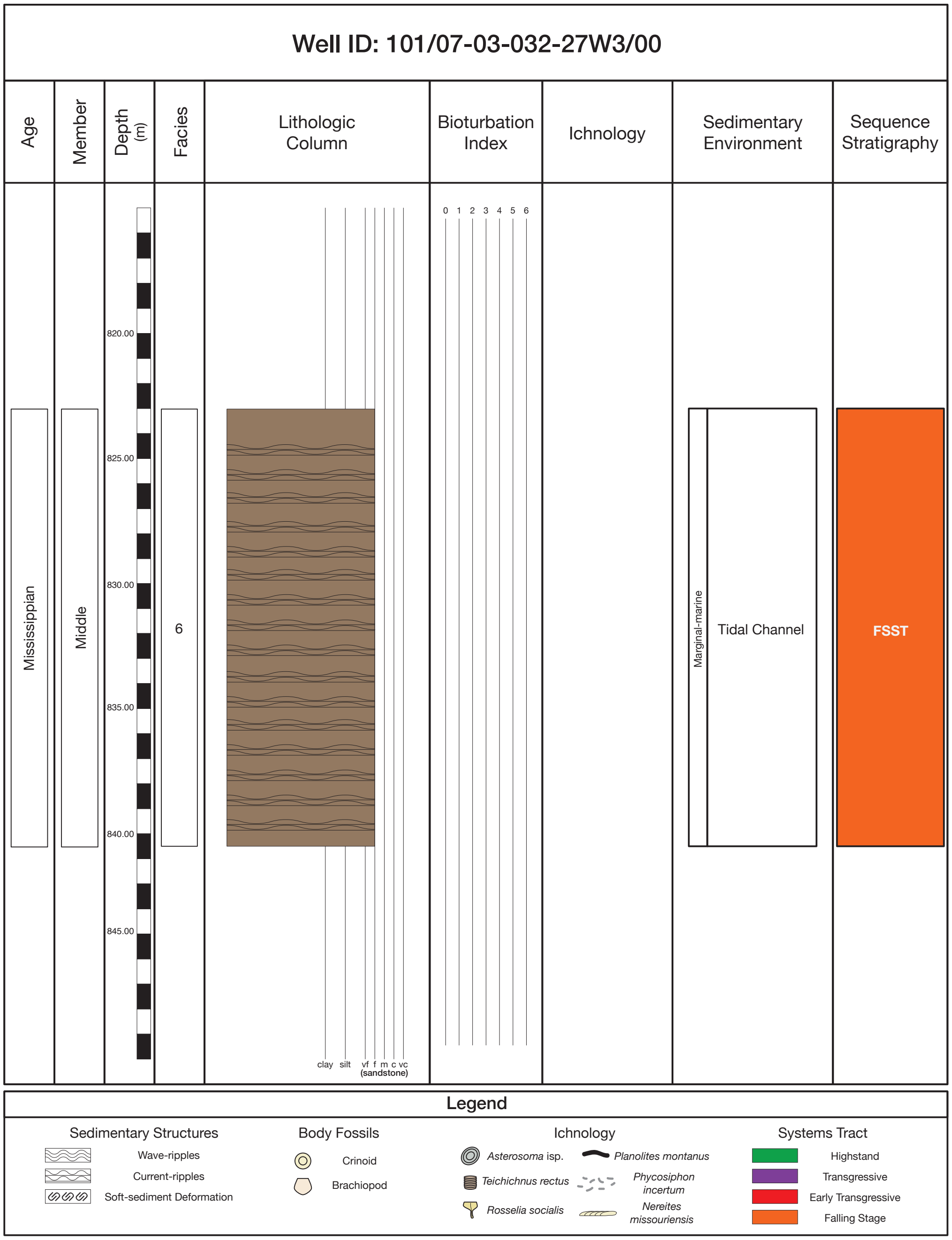
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Upper
Middle
780.00
785.00
790.00
795.00
800.00
1
2
6
5
6
5
6
0 1 2 3 4 5 6
clay silt vf f m c vc (sandstone)
Open-marine
Marginal-marine
Shelf
Offshore
Tidal Channel
Tidal Flat
Tidal Channel
Tidal Flat
Tidal Channel
TST2
FSST
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage

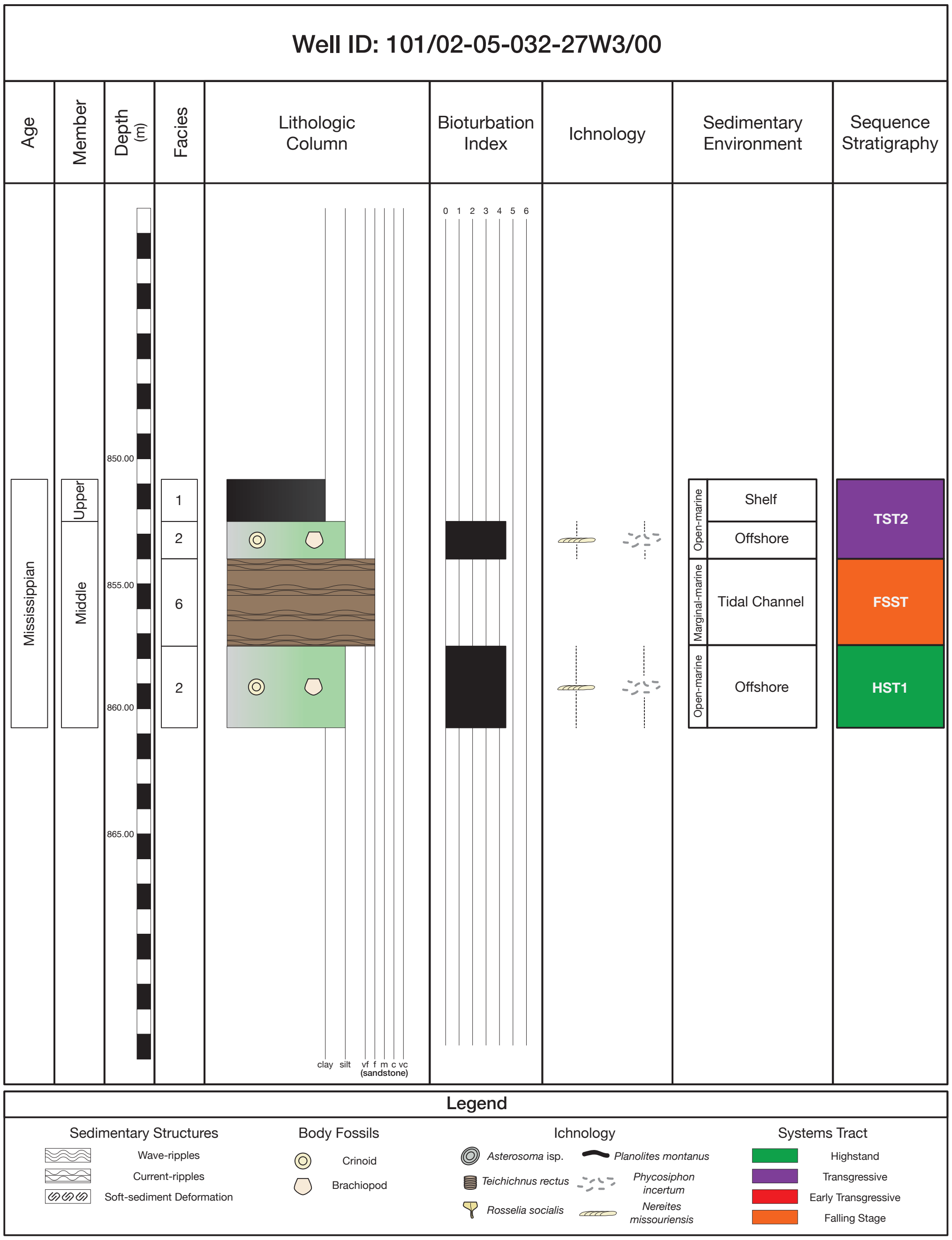


Well ID: 131/07-07-032-24W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Upper
Middle
800.00
805.00
810.00
815.00
1
2
5
6
3
clay silt vf f m c vc (sandstone)
0 1 2 3 4 5 6
Open-marine
Marginal-marine
Shelf
Offshore
Tidal Flat
Tidal Channel
Shoal
TST2
FSST
HST1
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage

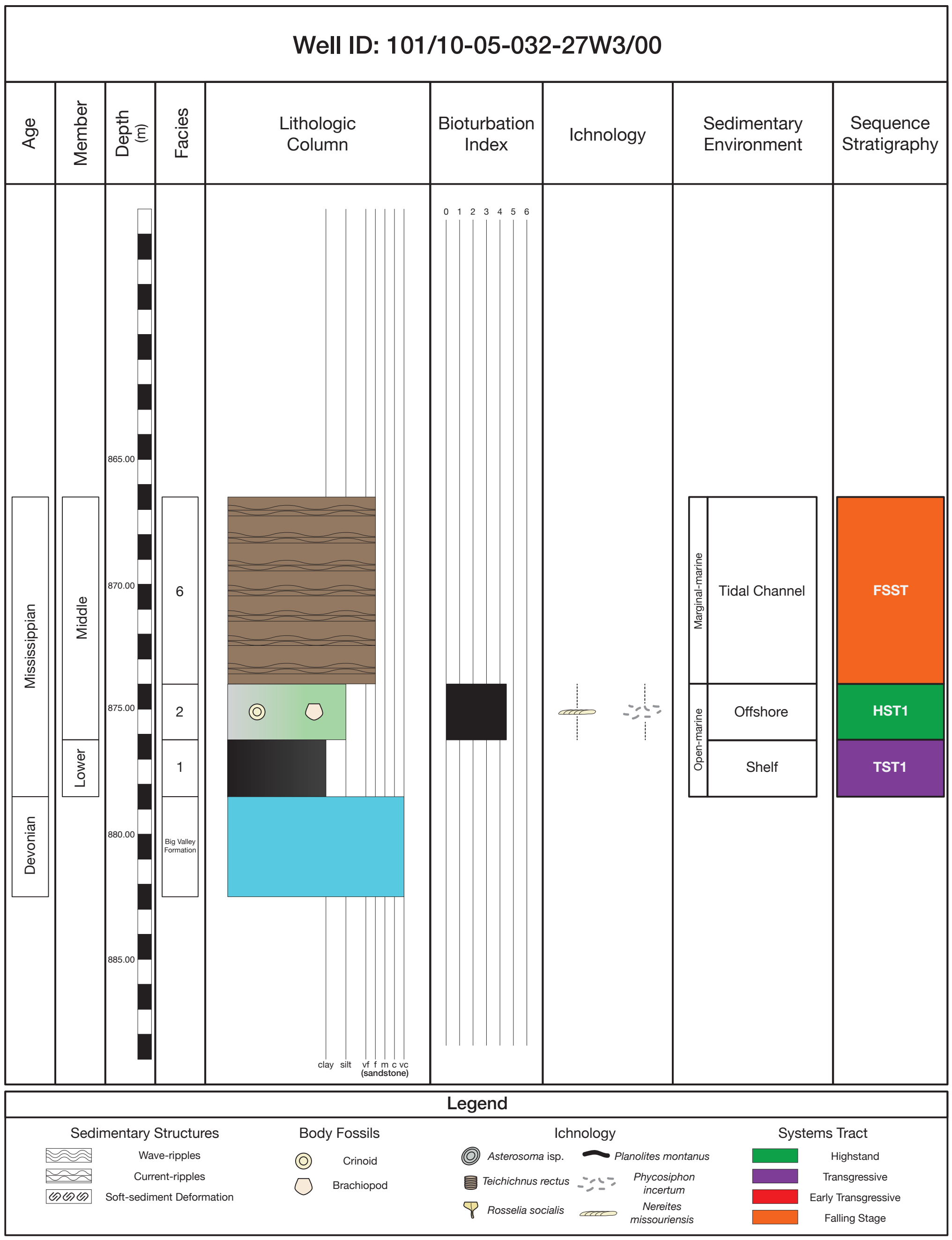

Well ID: 121/10-22-032-24W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Devonian
Middle
Lower
795.00
800.00
805.00
810.00
815.00
5
4
1
Big Valley Formation
0 1 2 3 4 5 6
clay silt vf f m c vc
(sandstone)
Marginal-marine
Open-marine
Tidal Flat
Shoal
Shelf
FSST
HST1
TST1
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage


Well ID: 111/10-15-032-25W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
0 1 2 3 4 5 6
795.00
800.00
805.00
810.00
Mississippian
Middle
6
Marginal-marine
Tidal Channel
FSST
clay silt vf f m c vc (sandstone)
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage

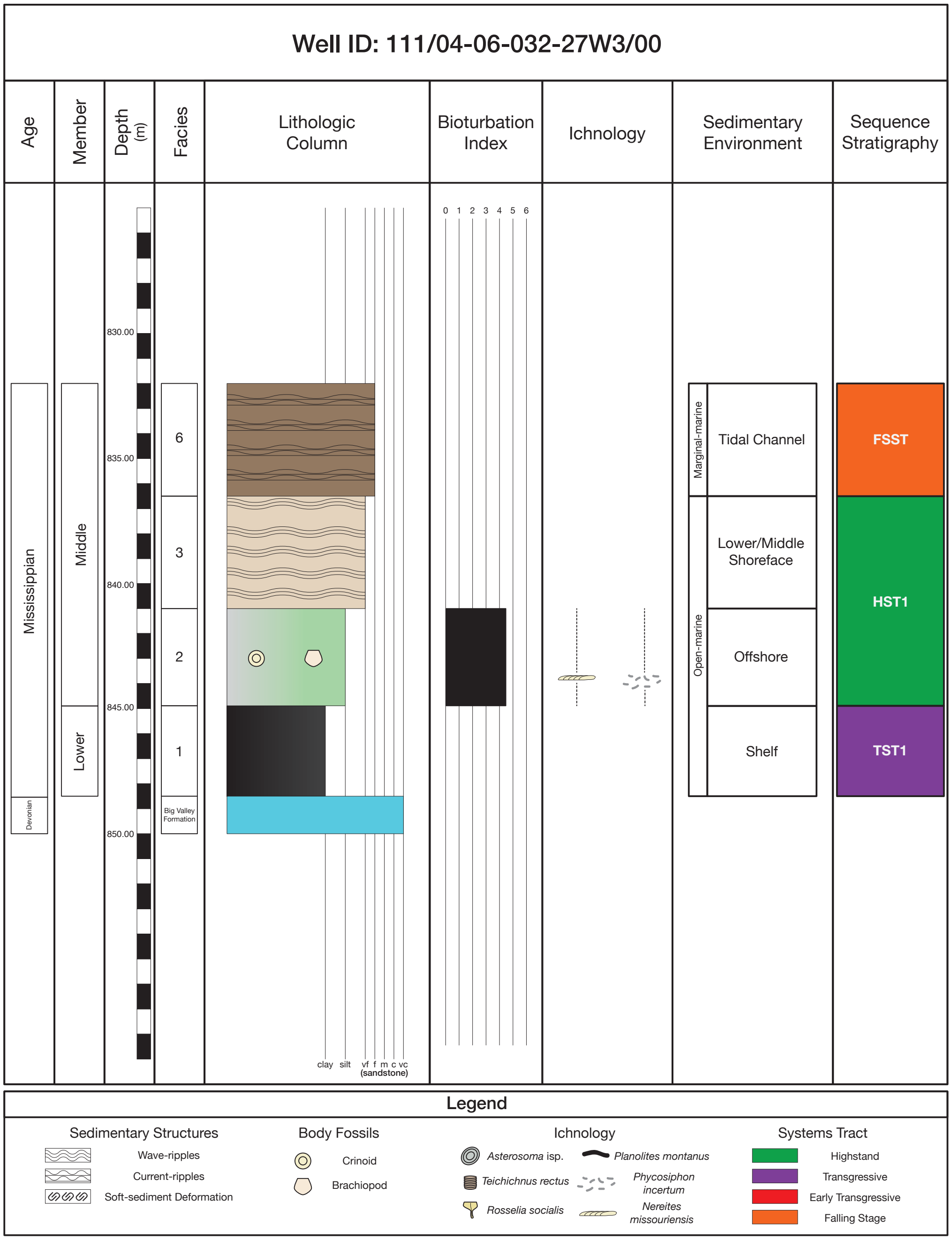

Well ID: 101/07-03-032-27W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Middle
820.00
825.00
830.00
835.00
840.00
845.00
6
0 1 2 3 4 5 6
clay silt vf f m c vc (sandstone)
Marginal-marine
Tidal Channel
FSST
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage



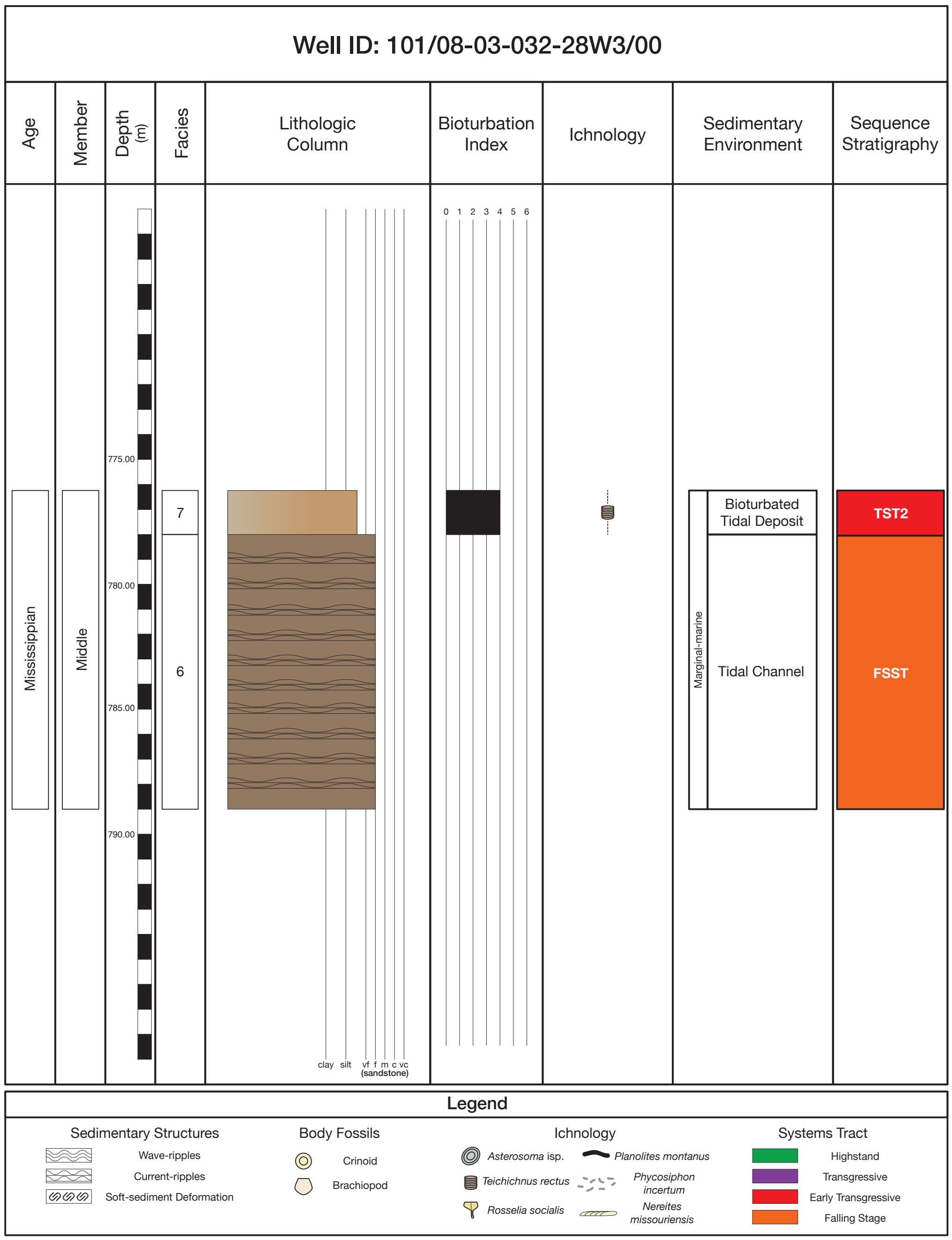
Well ID: 101/02-05-032-27W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Upper
Middle
850.00
855.00
860.00
865.00
1
2
6
2
clay silt vf f m c vc (sandstone)
0 1 2 3 4 5 6
Open-marine
Marginal-marine
Open-marine
Shelf
Offshore
Tidal Channel
Offshore
TST2
FSST
HST1
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage



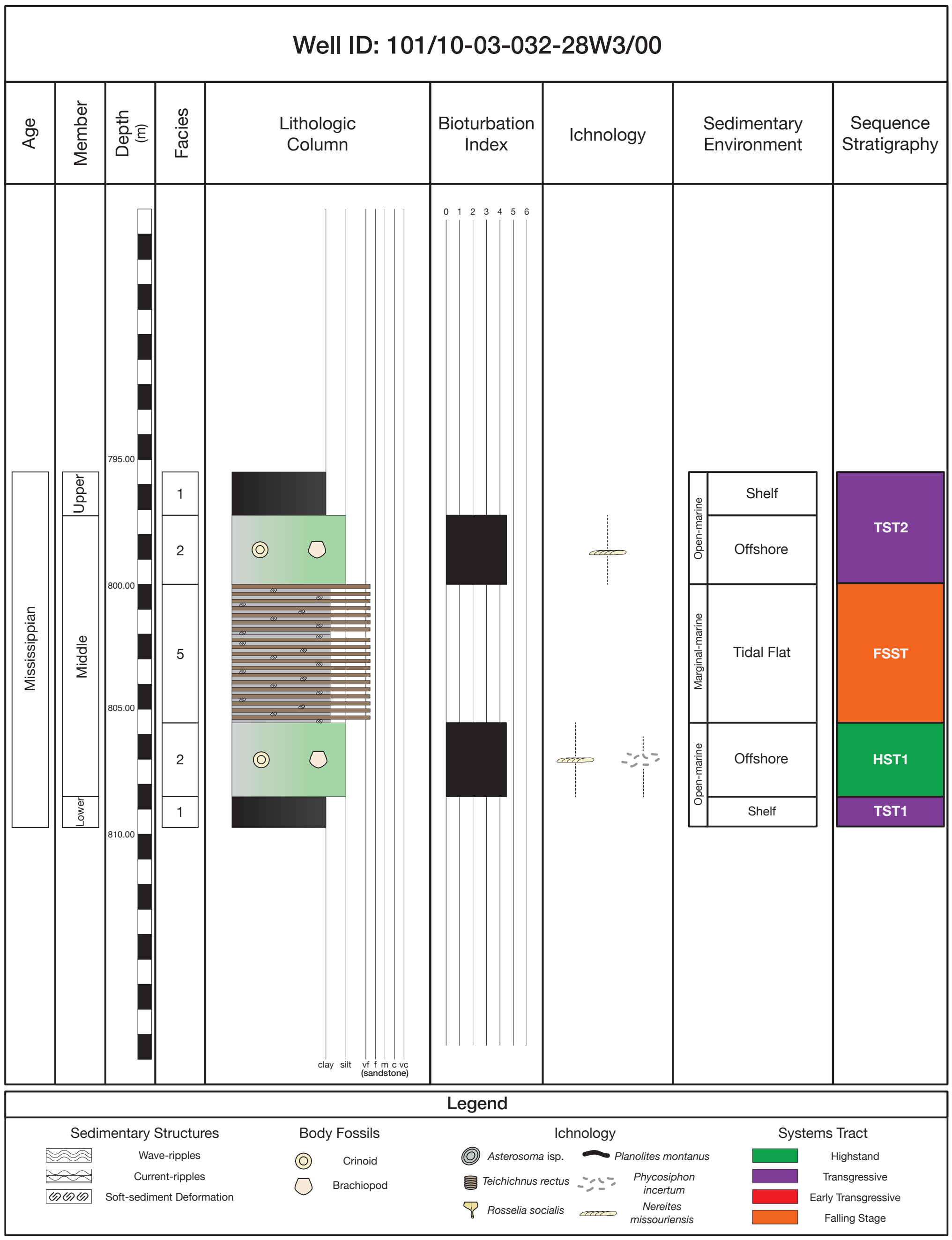
Well ID: 101/10-05-032-27W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Devonian
Middle
Lower
865.00
870.00
875.00
880.00
885.00
6
2
1
Big Valley Formation
clay silt vf f m c vc (sandstone)
0 1 2 3 4 5 6
Marginal-marine
Open-marine
Tidal Channel
Offshore
Shelf
FSST
HST1
TST1
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage



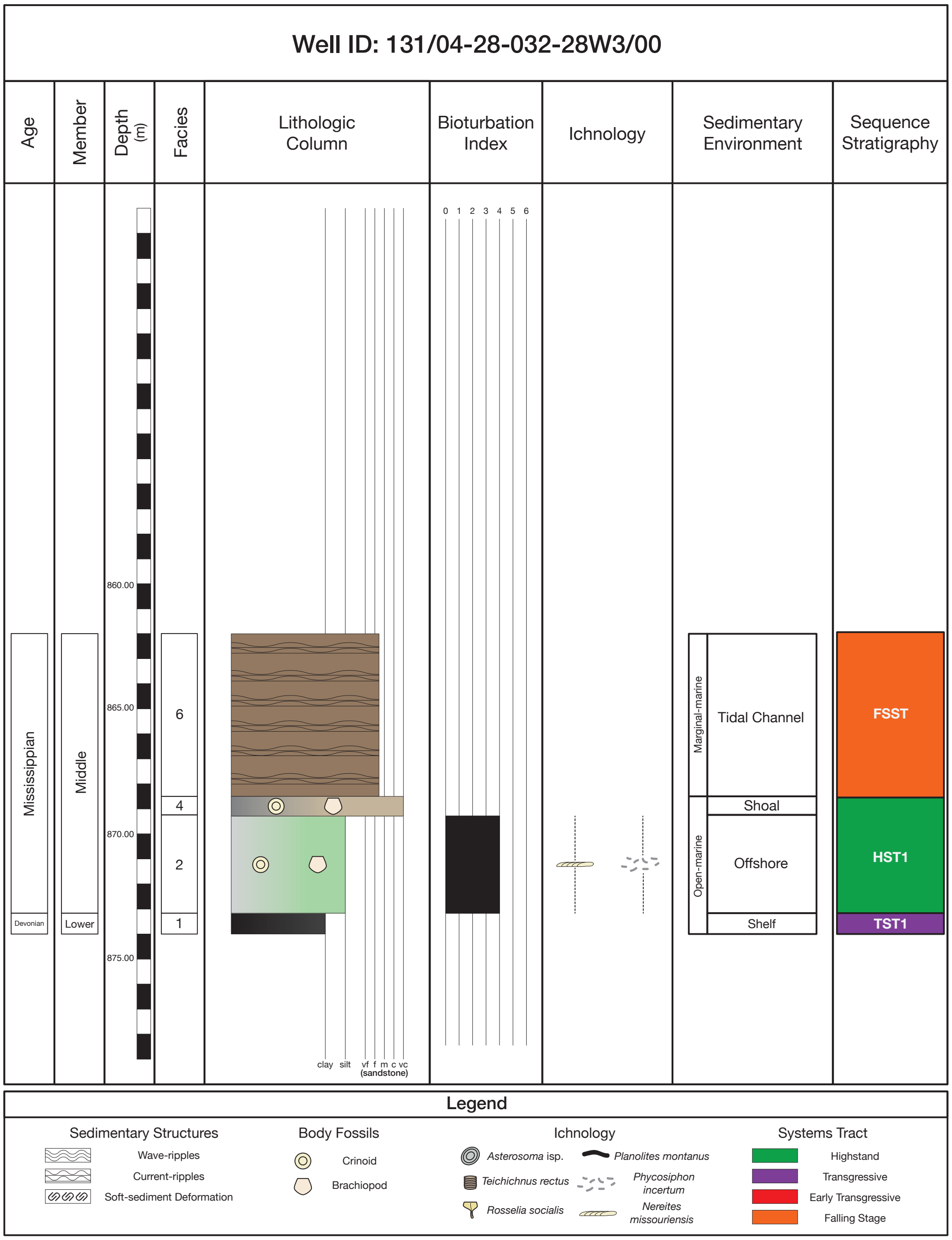
Well ID: 111/04-06-032-27W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Devonian
Middle
Lower
830.00
835.00
840.00
845.00
850.00
6
3
2
1
Big Valley Formation
clay silt vf f m c vc (sandstone)
0 1 2 3 4 5 6
Marginal-marine
Open-marine
Tidal Channel
Lower/Middle Shoreface
Offshore
Shelf
FSST
HST1
TST1
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Teichichnus rectus
Rosselia socialis
Planolites montanus
Phycosiphon incertum
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage

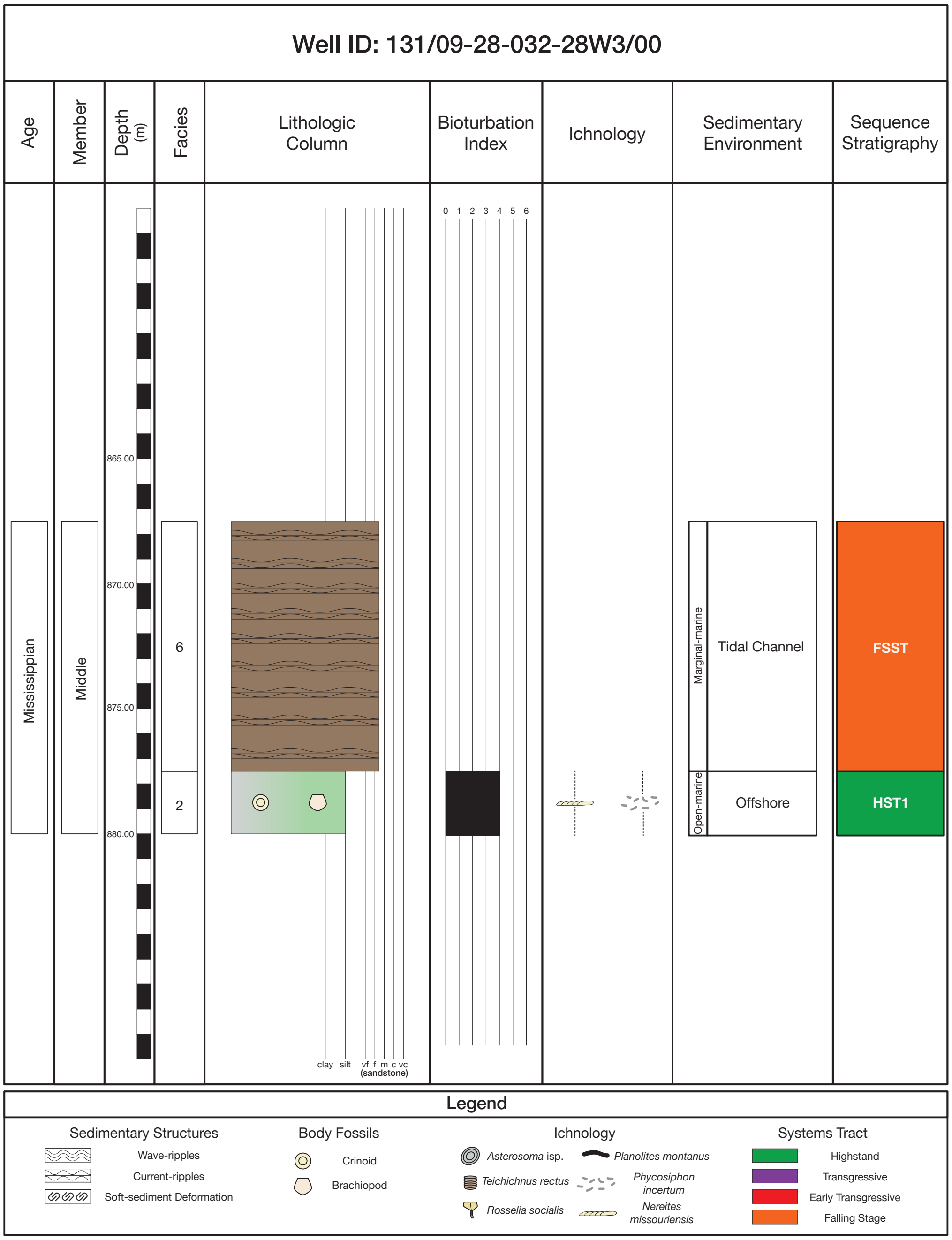


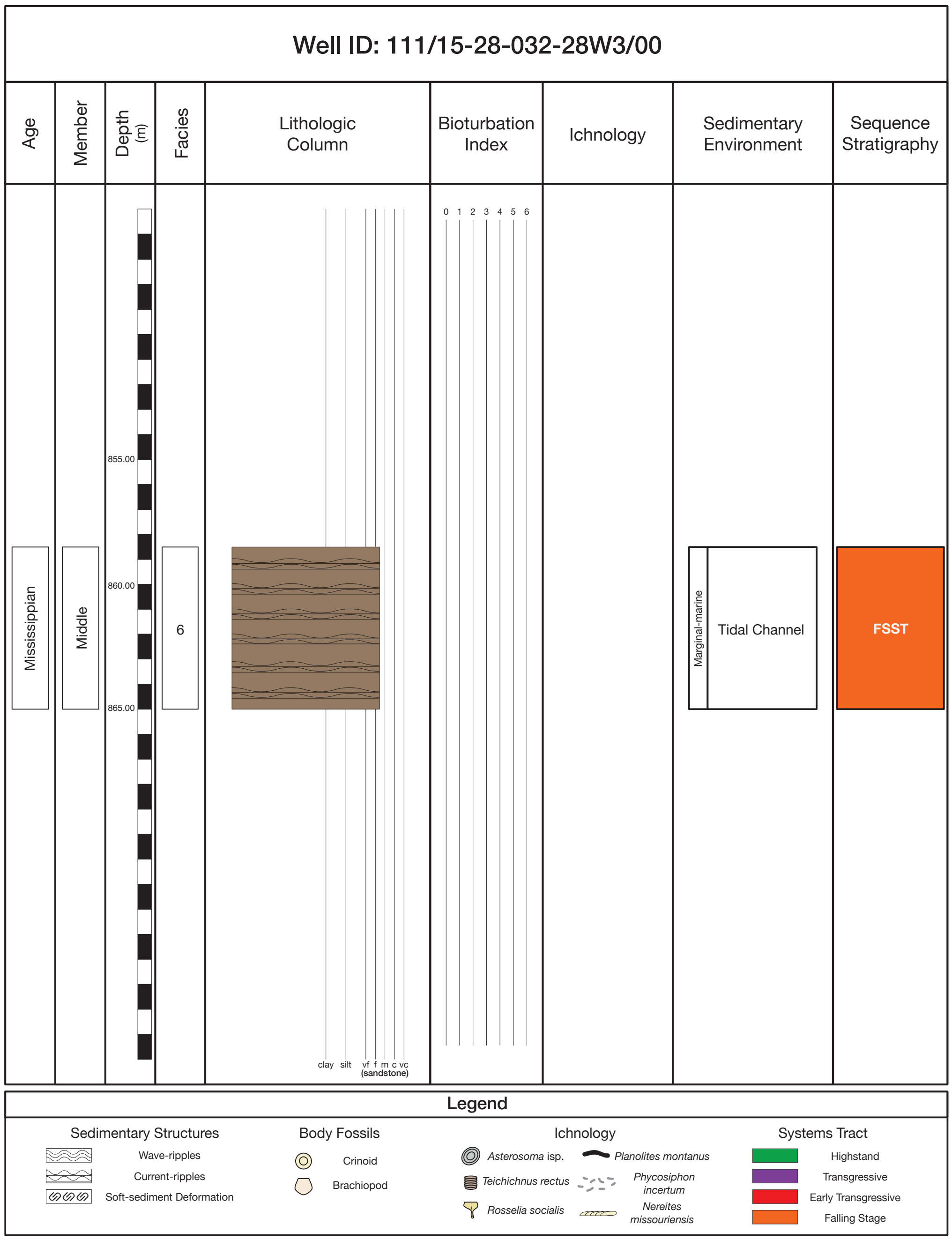
Well ID: 101/08-03-032-28W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
0 1 2 3 4 5 6
775.00
780.00
785.00
790.00
Mississippian
Middle
7
6
Marginal-marine
Bioturbated Tidal Deposit
Tidal Channel
TST2
FSST
clay silt vf f m c vc
(sandstone)
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage

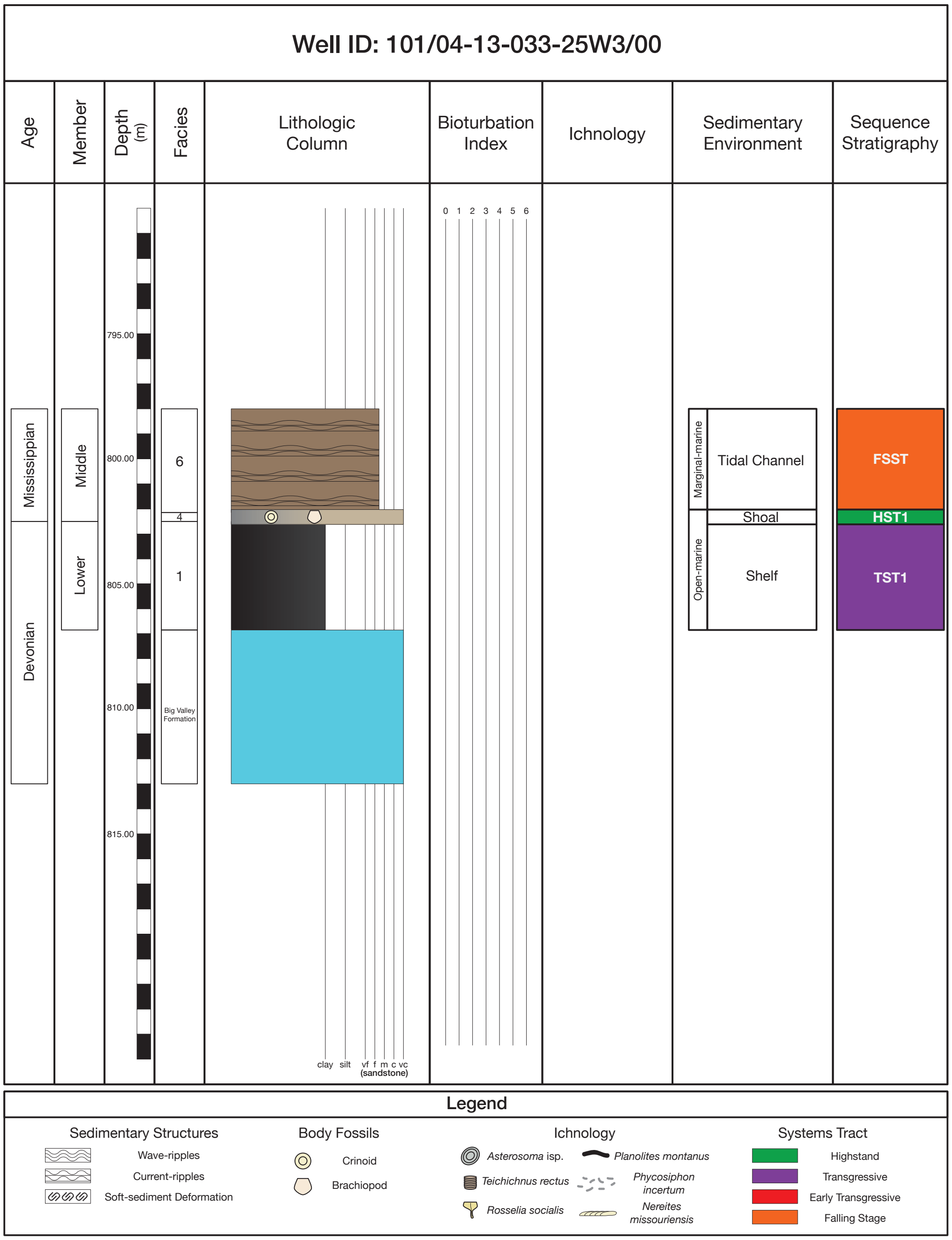


Well ID: 101/10-03-032-28W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Upper
Middle
Lower
795.00
800.00
805.00
810.00
1
2
5
2
1
clay silt vf f m c vc (sandstone)
0 1 2 3 4 5 6
Open-marine
Marginal-marine
Open-marine
Shelf
Offshore
Tidal Flat
Offshore
Shelf
TST2
FSST
HST1
TST1
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage

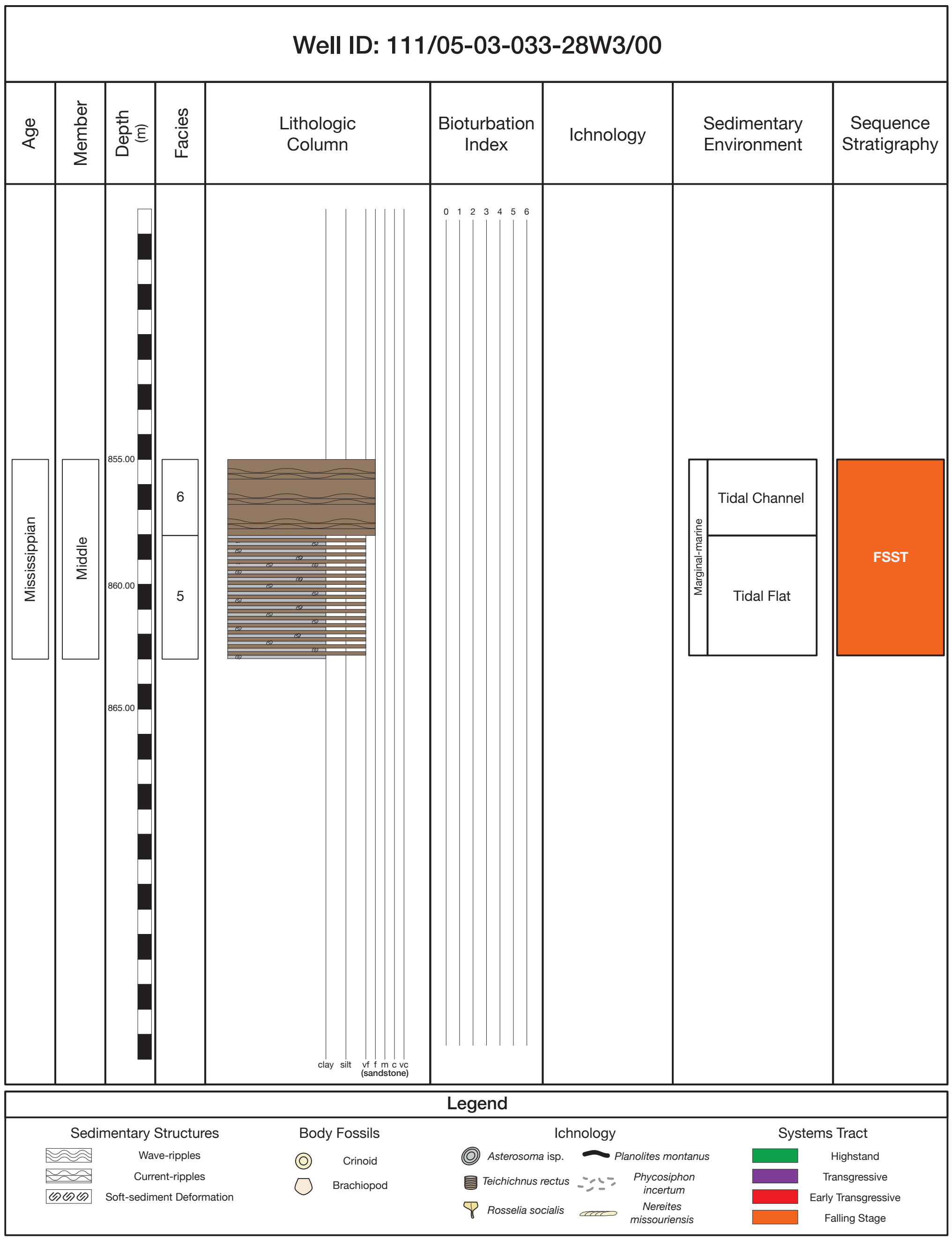

Well ID: 131/04-28-032-28W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Devonian
Middle
Lower
860.00
865.00
870.00
875.00
6
4
2
1
clay silt vf f m c vc (sandstone)
0 1 2 3 4 5 6
Marginal-marine
Open-marine
Tidal Channel
Shoal
Offshore
Shelf
FSST
HST1
TST1
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage

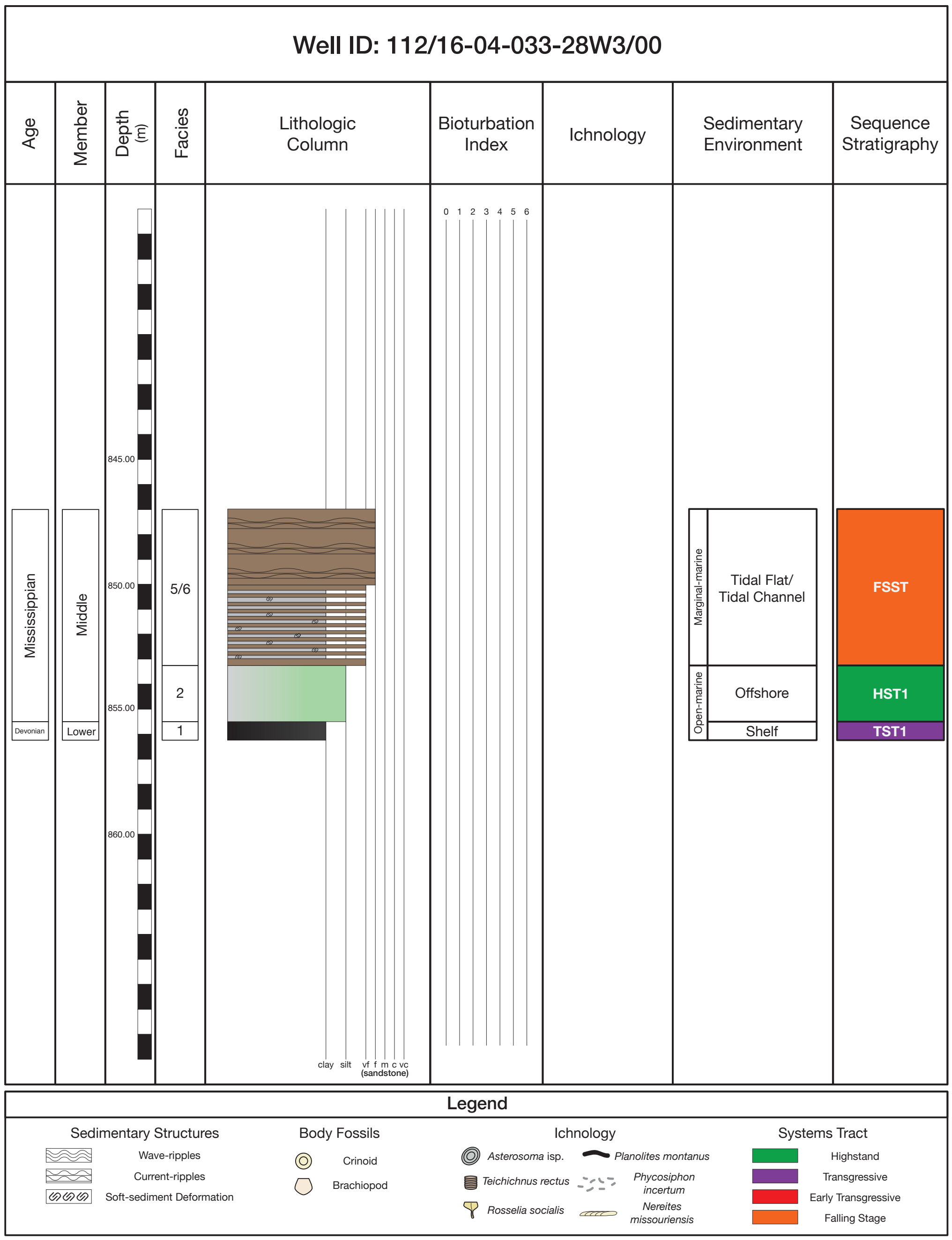

Well ID: 131/09-28-032-28W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
0 1 2 3 4 5 6
865.00
870.00
875.00
880.00
Mississippian
Middle
6
2
clay silt vf f m c vc (sandstone)
Marginal-marine
Open-marine
Tidal Channel
Offshore
FSST
HST1
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage

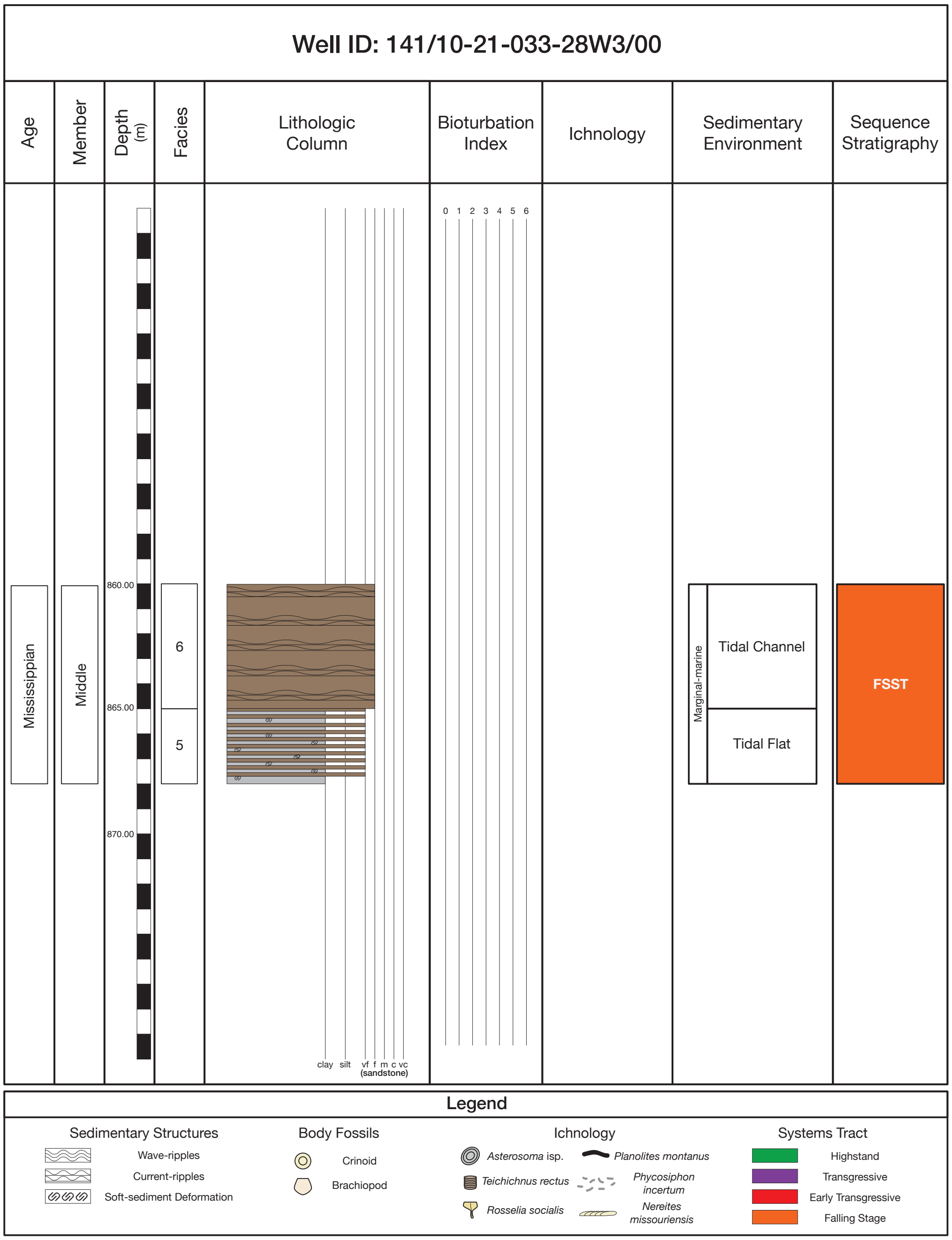

Well ID: 111/15-28-032-28W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
0 1 2 3 4 5 6
855.00
860.00
865.00
Mississippian
Middle
6
Marginal-marine
Tidal Channel
FSST
clay silt vf f m c vc (sandstone)
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage



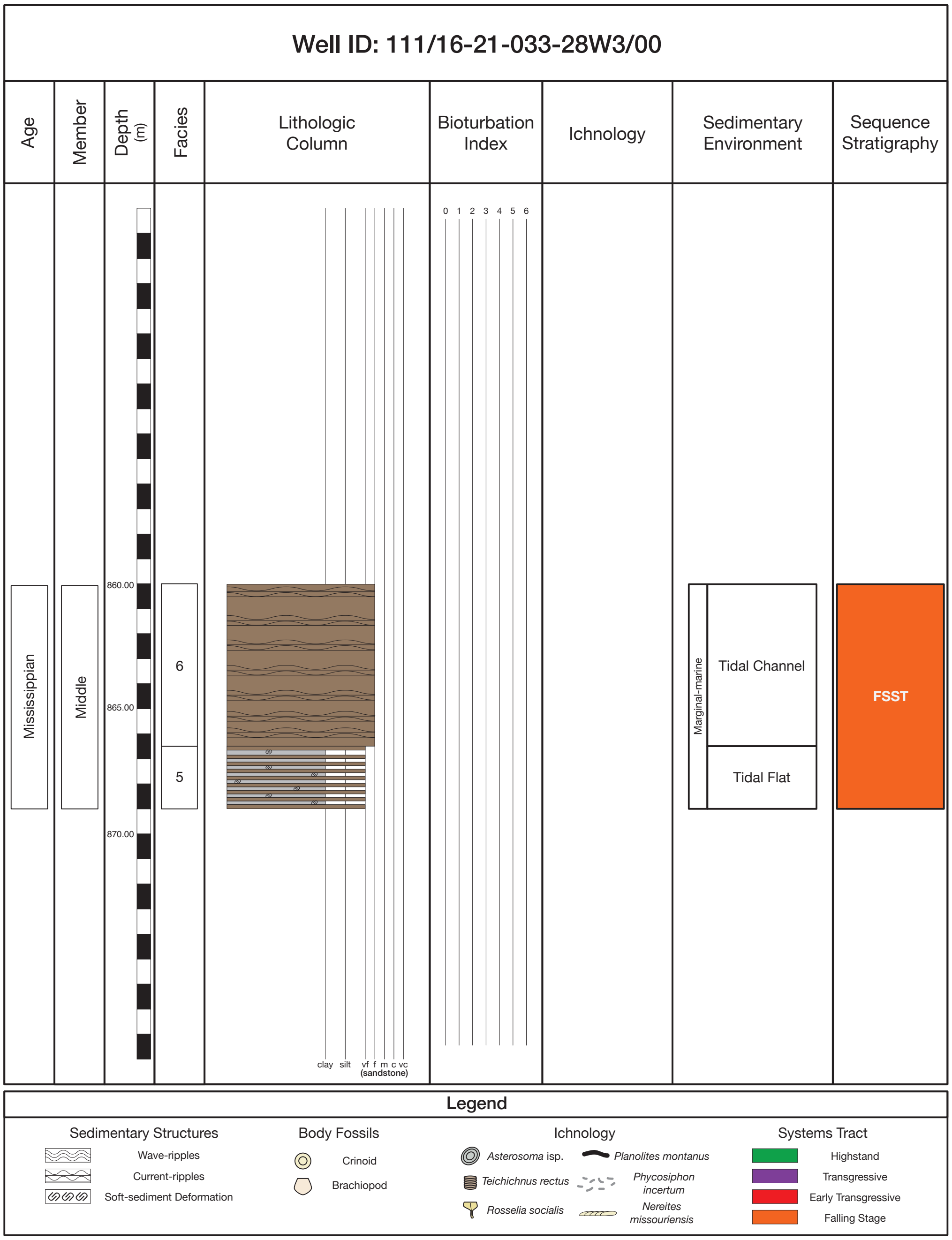
Well ID: 101/04-13-033-25W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
0 1 2 3 4 5 6
795.00
800.00
805.00
810.00
815.00
Mississippian
Devonian
Middle
Lower
6
4
1
Big Valley Formation
clay silt vf f m c vc (sandstone)
Marginal-marine
Open-marine
Tidal Channel
Shoal
Shelf
FSST
HST1
TST1
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage


Well ID: 111/05-03-033-28W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Middle
855.00
860.00
865.00
6
5
0 1 2 3 4 5 6
clay silt vf f m c vc (sandstone)
Marginal-marine
Tidal Channel
Tidal Flat
FSST
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage

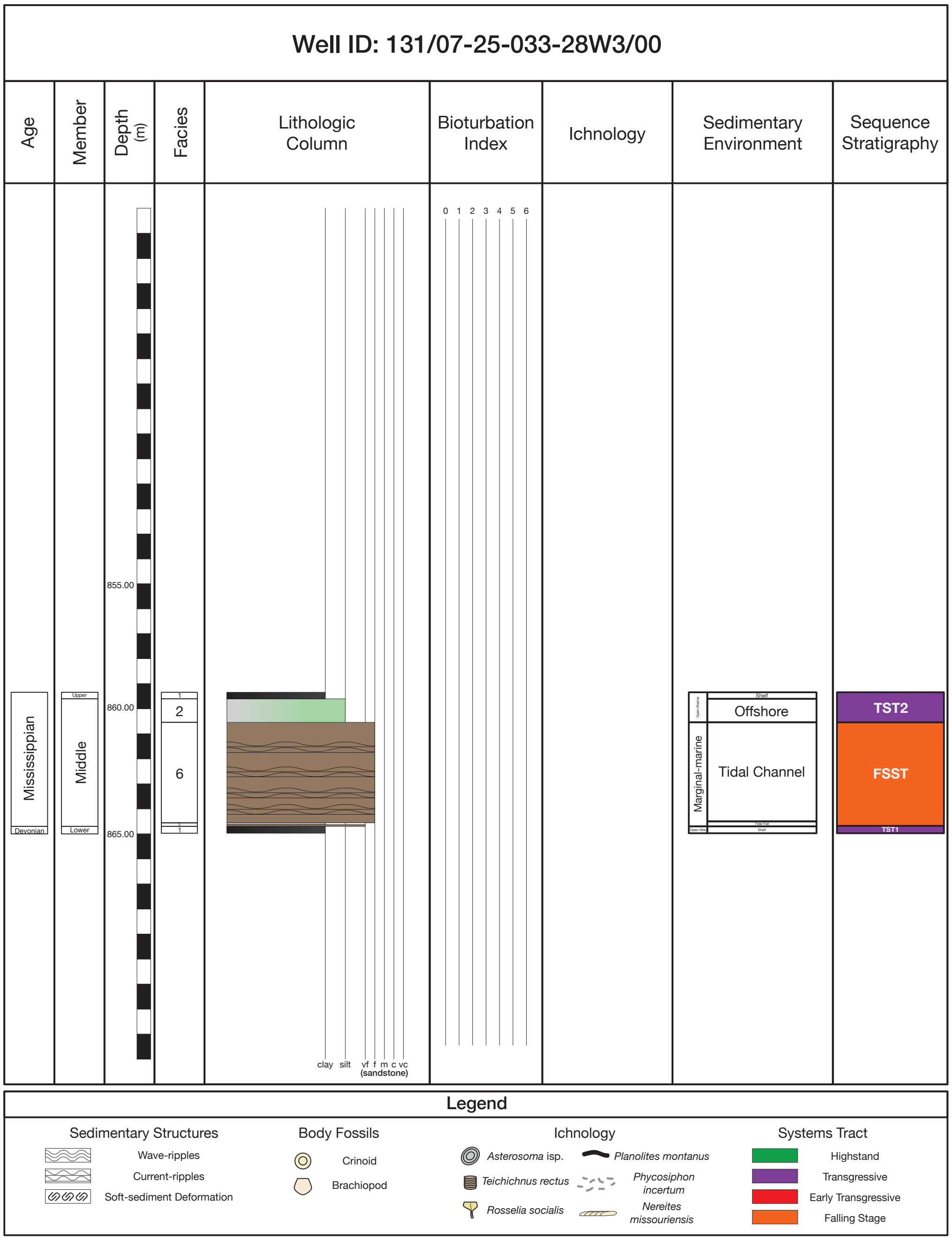

Well ID: 112/16-04-033-28W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Devonian
Middle
Lower
845.00
850.00
855.00
860.00
5/6
2
1
0 1 2 3 4 5 6
clay silt vf f m c vc
(sandstone)
Marginal-marine
Open-marine
Tidal Flat/ Tidal Channel
Offshore
Shelf
FSST
HST1
TST1
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage



Well ID: 141/10-21-033-28W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
0 1 2 3 4 5 6
860.00
865.00
870.00
Mississippian
Middle
6
5
clay silt vf f m c vc (sandstone)
Marginal-marine
Tidal Channel
Tidal Flat
FSST
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage



Well ID: 111/16-21-033-28W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
0 1 2 3 4 5 6
860.00
865.00
870.00
Mississippian
Middle
6
5
clay silt vf f m c vc (sandstone)
Marginal-marine
Tidal Channel
Tidal Flat
FSST
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage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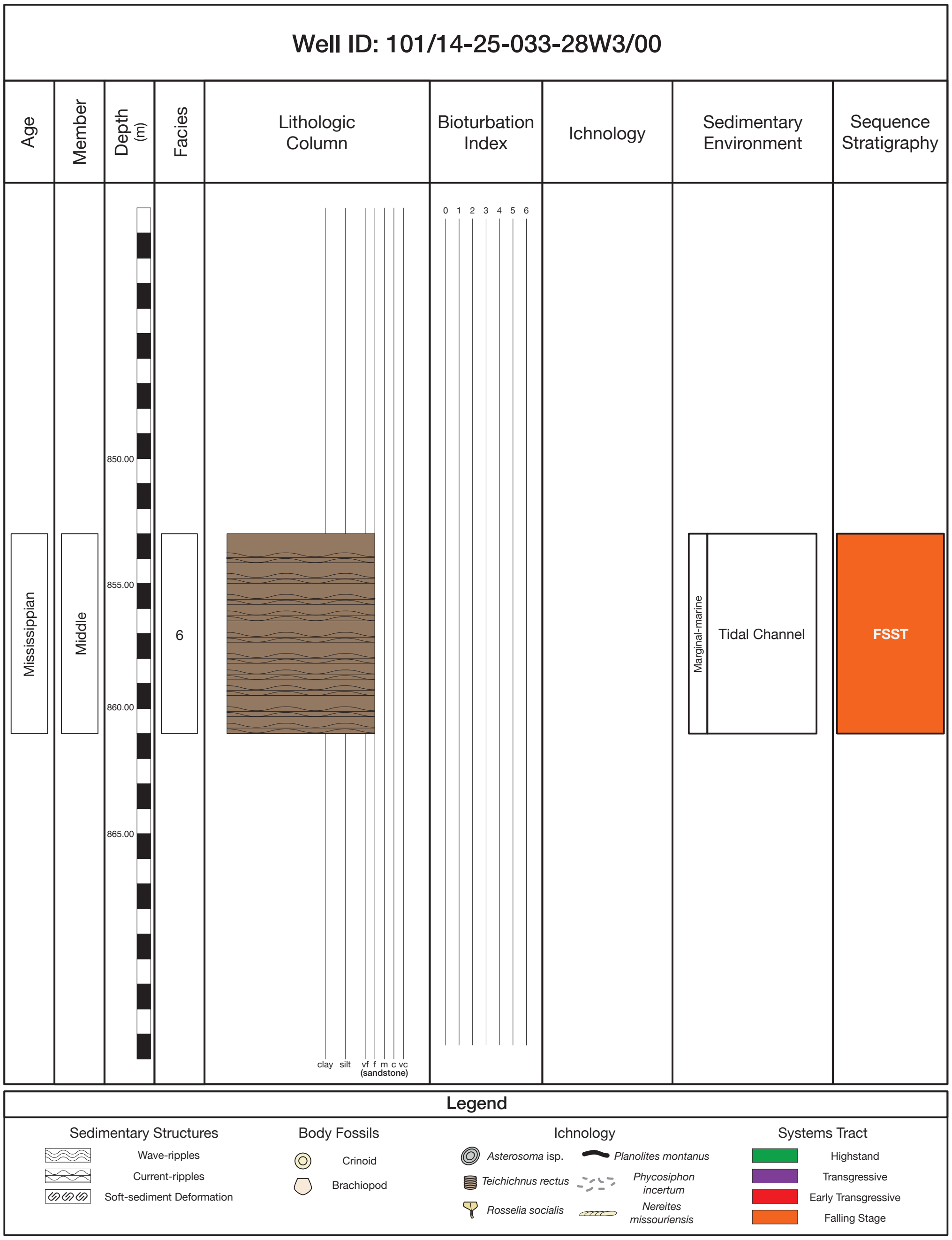
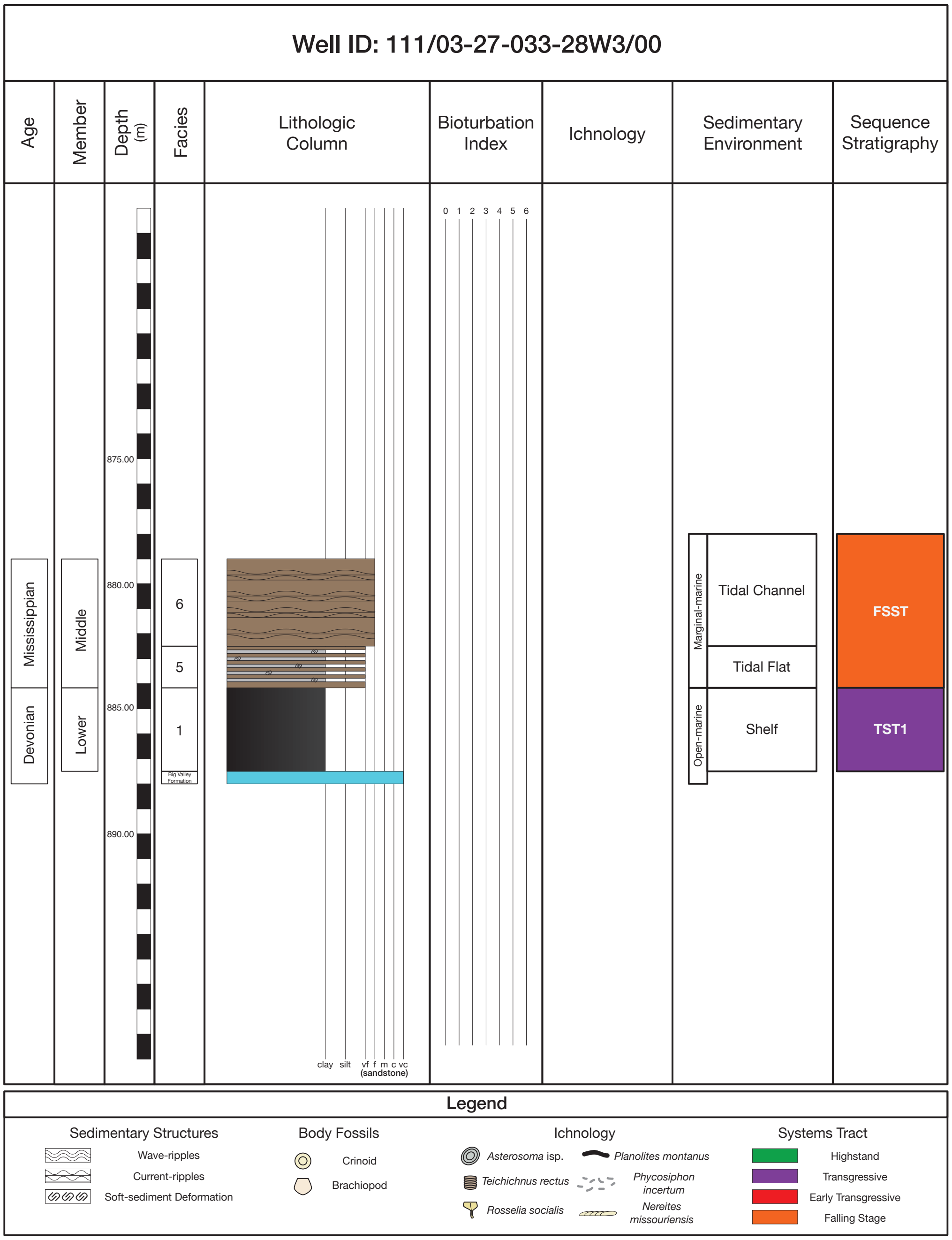
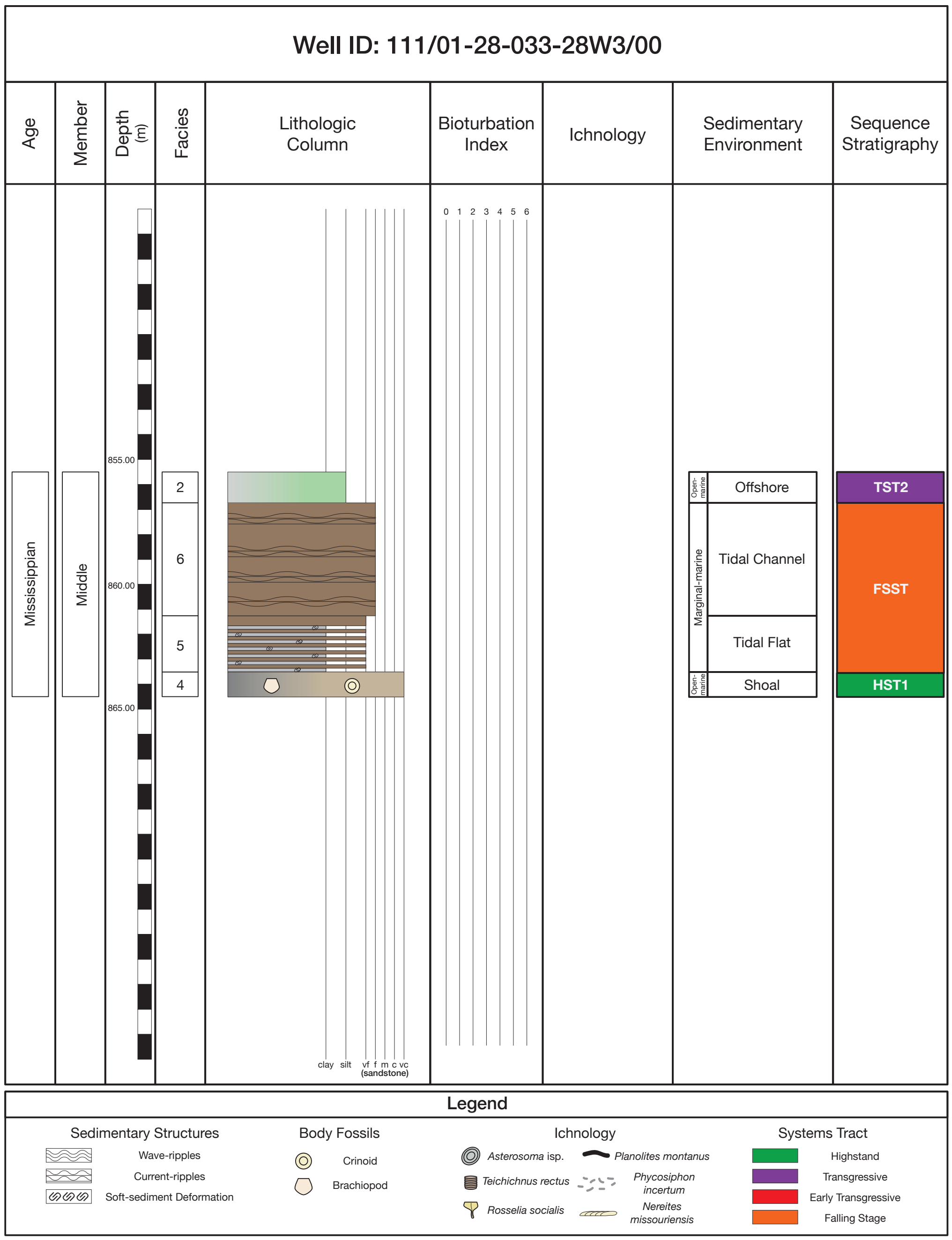
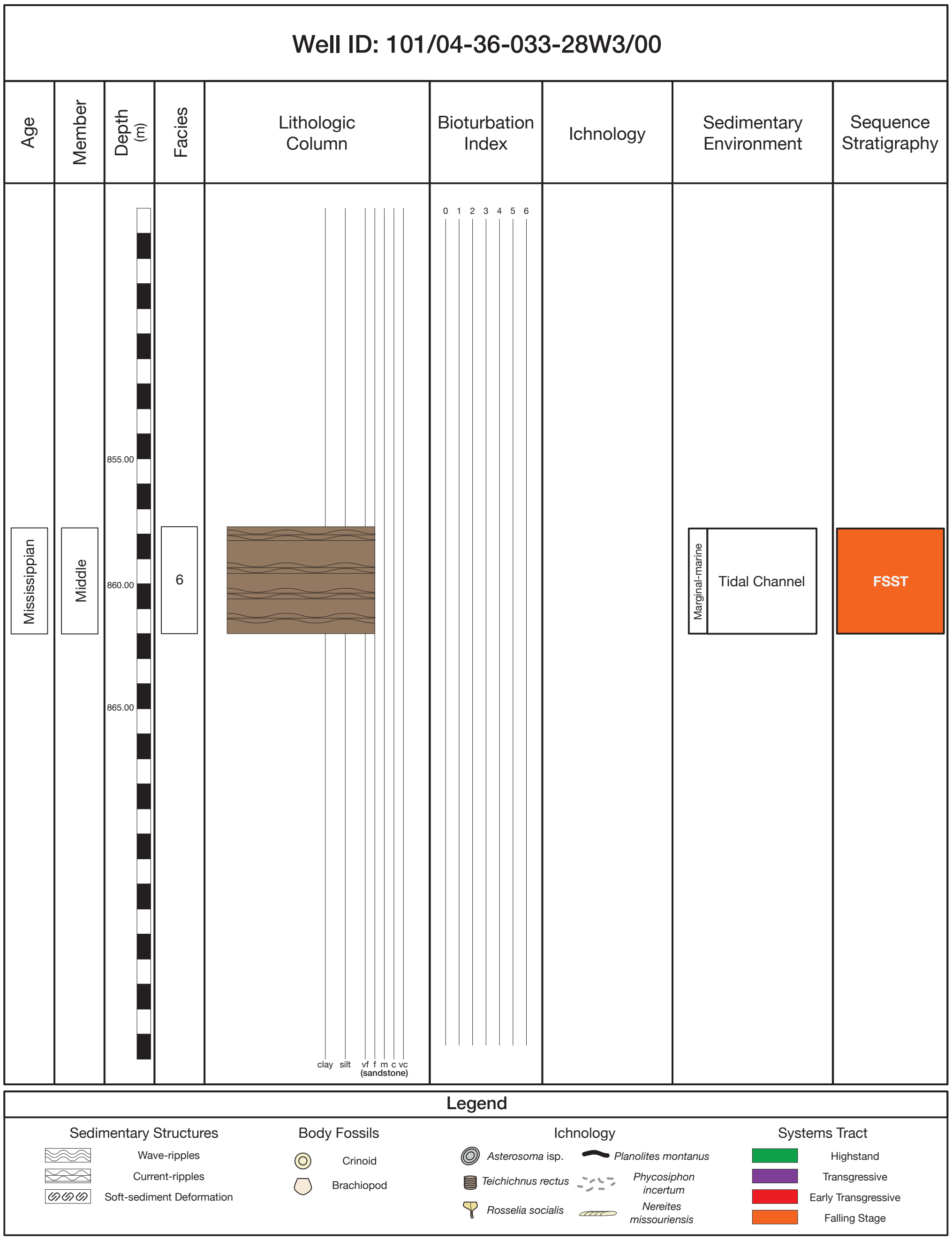
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
0 1 2 3 4 5 6
855.00
860.00
865.00
Mississippian
Devonian
Upper
Middle
Lower
2
6
Offshore
Tidal Channel
Marginal-marine
TST2
FSST
TST1
clay silt vf f m c vc
(sandstone)
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage


Well ID: 101/14-25-033-28W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
0 1 2 3 4 5 6
850.00
855.00
860.00
865.00
Mississippian
Middle
6
Marginal-marine
Tidal Channel
FSST
clay silt vf f m c vc (sandstone)
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Teichichnus rectus
Rosselia socialis
Planolites montanus
Phycosiphon incertum
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage


Well ID: 111/03-27-033-28W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Devonian
Middle
Lower
875.00
880.00
885.00
890.00
6
5
1
Big Valley Formation
0 1 2 3 4 5 6
clay silt vf f m c vc (sandstone)
Marginal-marine
Open-marine
Tidal Channel
Tidal Flat
Shelf
FSST
TST1
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Teichichnus rectus
Rosselia socialis
Planolites montanus
Phycosiphon incertum
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage



Well ID: 111/01-28-033-28W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Middle
855.00
860.00
865.00
2
6
5
4
0 1 2 3 4 5 6
clay silt vf f m c vc (sandstone)
Open-marine
Marginal-marine
Offshore
Tidal Channel
Tidal Flat
Shoal
TST2
FSST
HST1
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage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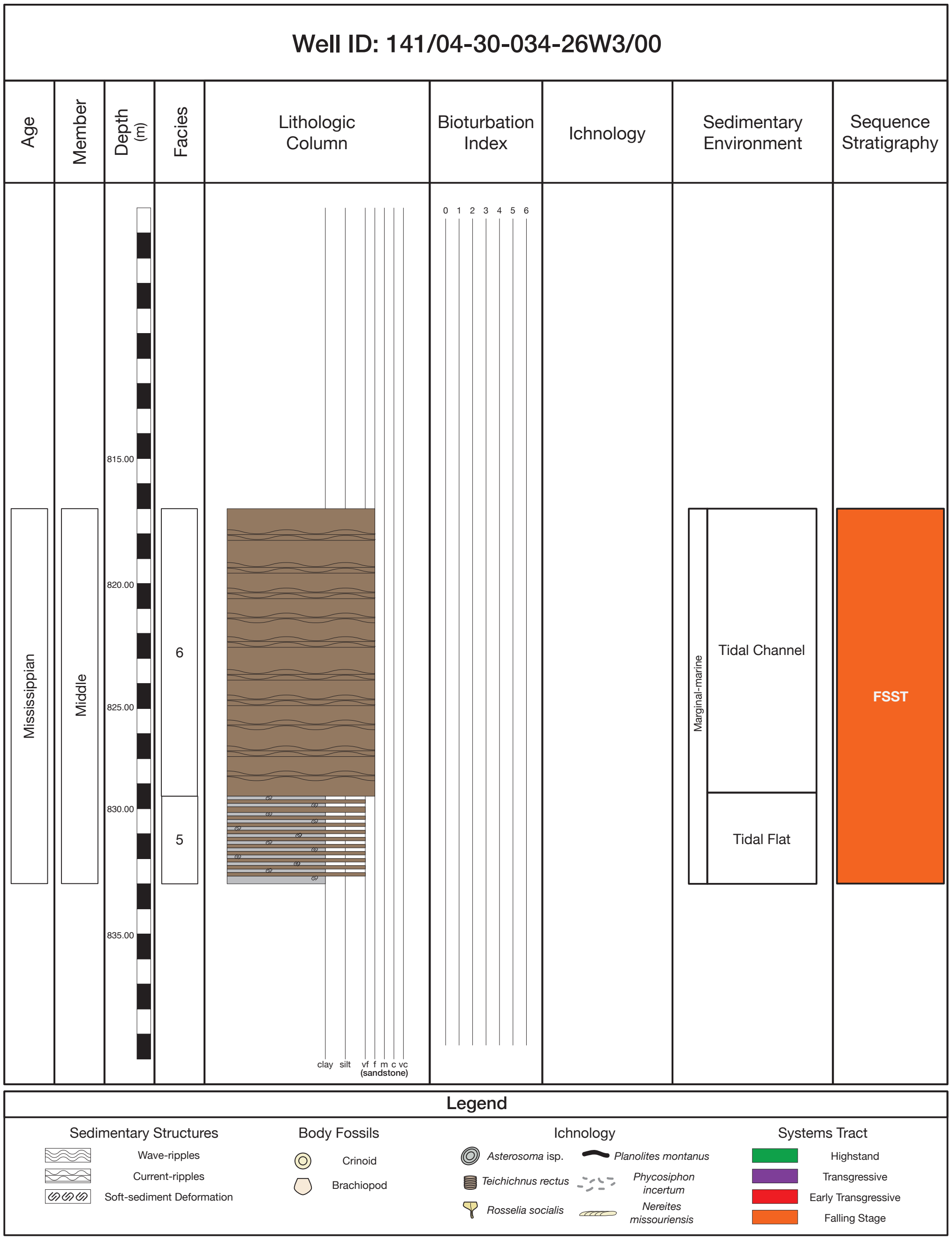
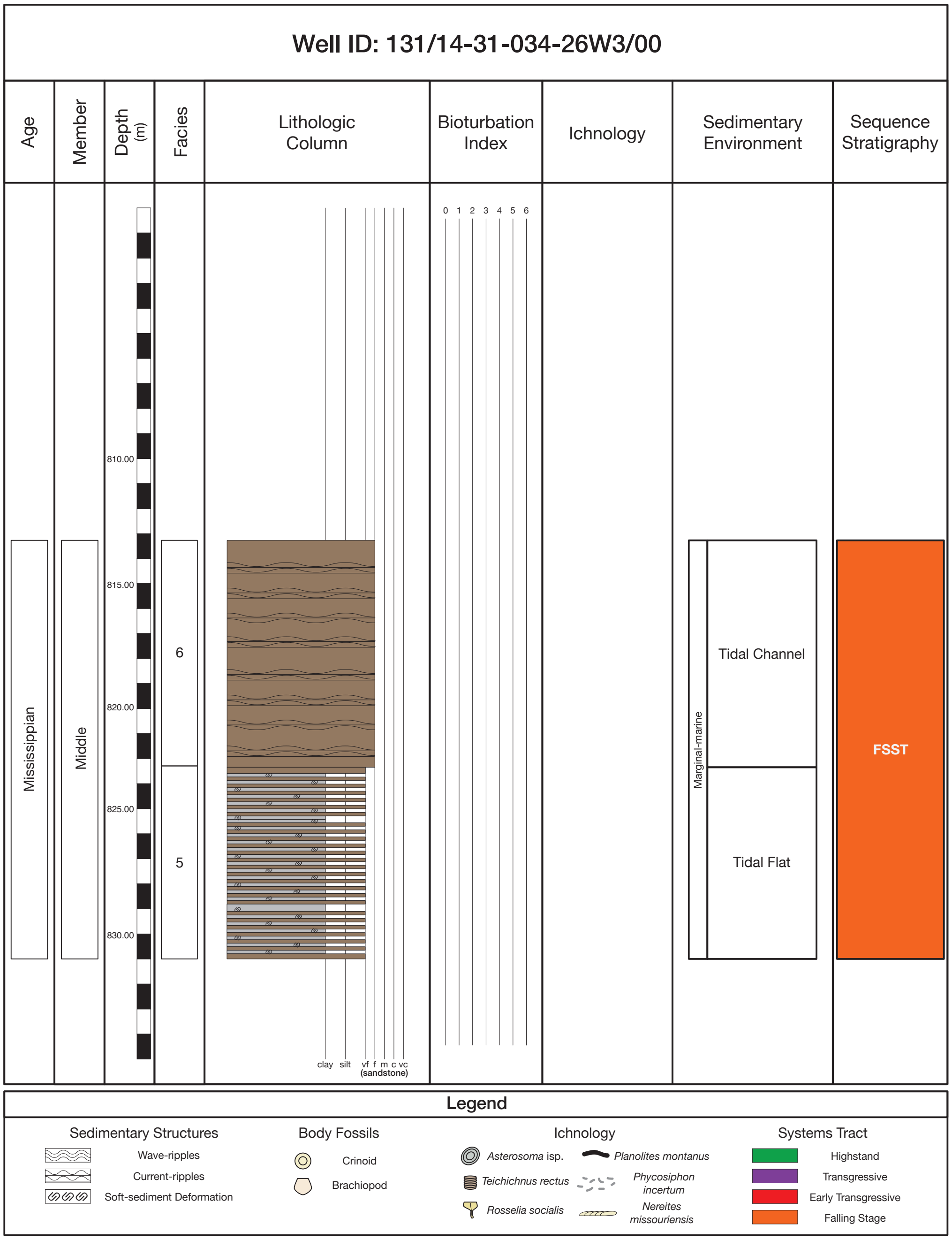
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Middle
855.00
860.00
865.00
6
0 1 2 3 4 5 6
clay silt vf f m c vc (sandstone)
Marginal-marine
Tidal Channel
FSST
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage


Well ID: 141/04-30-034-26W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
0 1 2 3 4 5 6
815.00
820.00
825.00
830.00
835.00
Mississippian
Middle
6
5
clay silt vf f m c vc (sandstone)
Marginal-marine
Tidal Channel
Tidal Flat
FSST
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage


Well ID: 131/14-31-034-26W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
0 1 2 3 4 5 6
810.00
815.00
820.00
825.00
830.00
Mississippian
Middle
6
5
clay silt vf f m c vc (sandstone)
Marginal-marine
Tidal Channel
Tidal Flat
FSST
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
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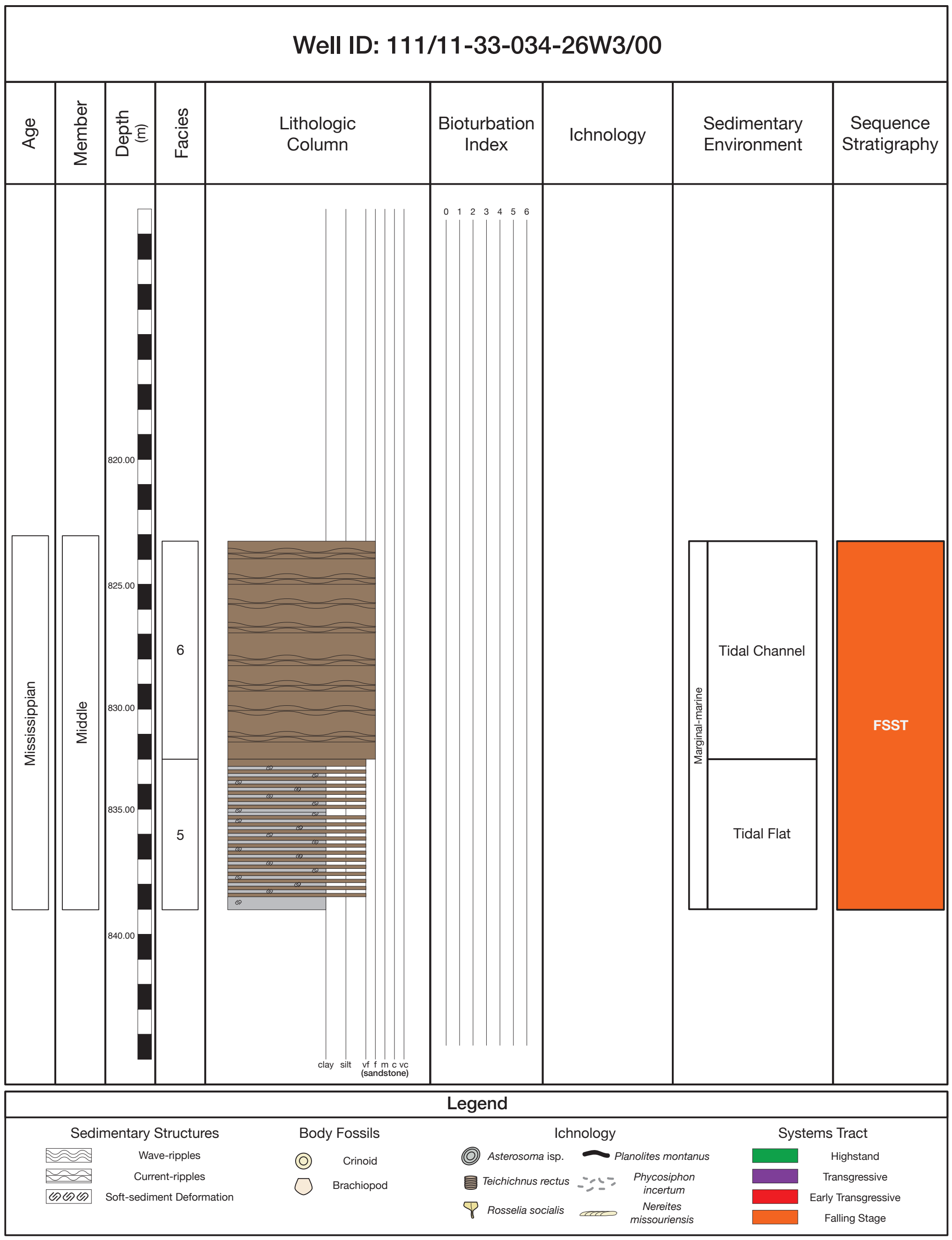
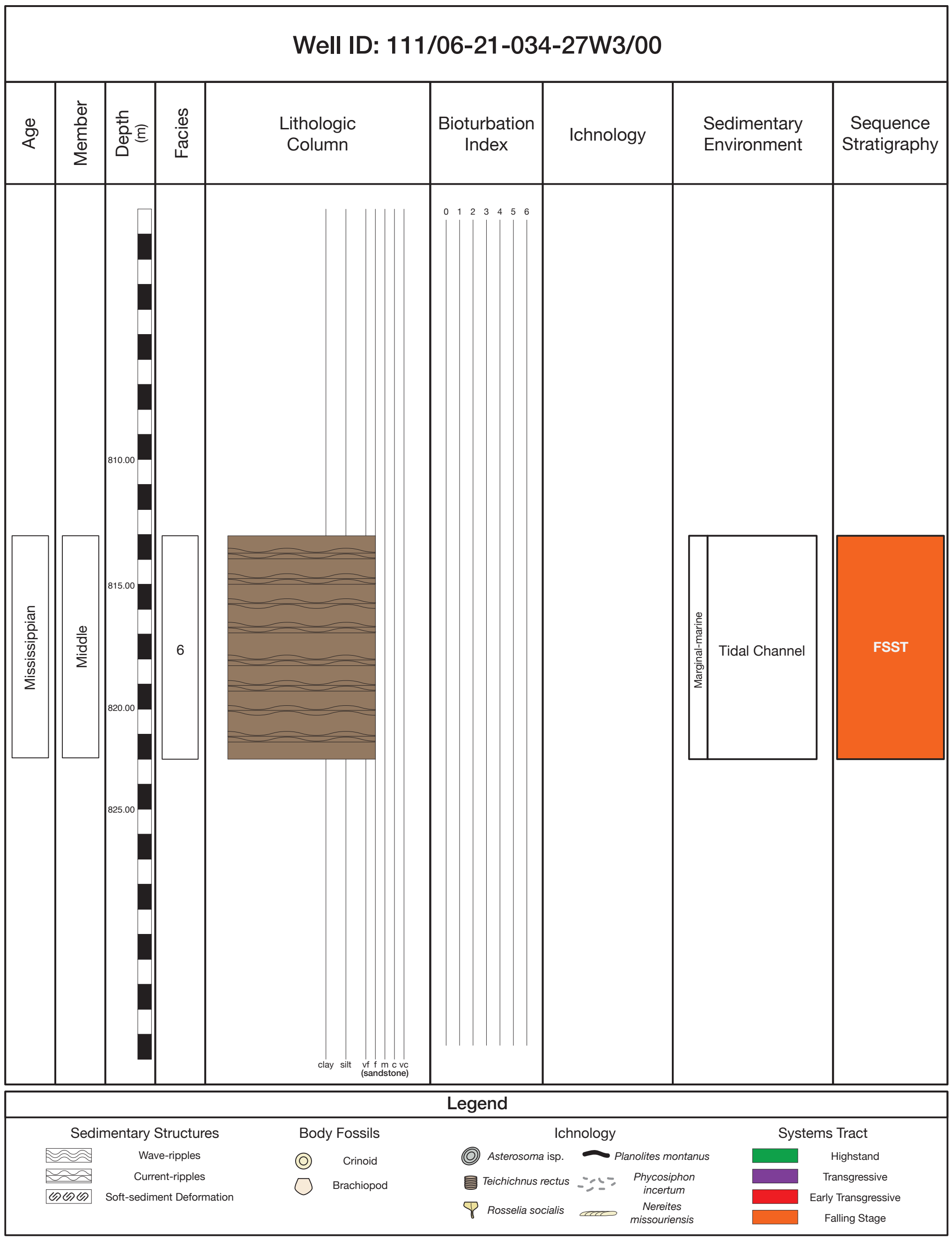
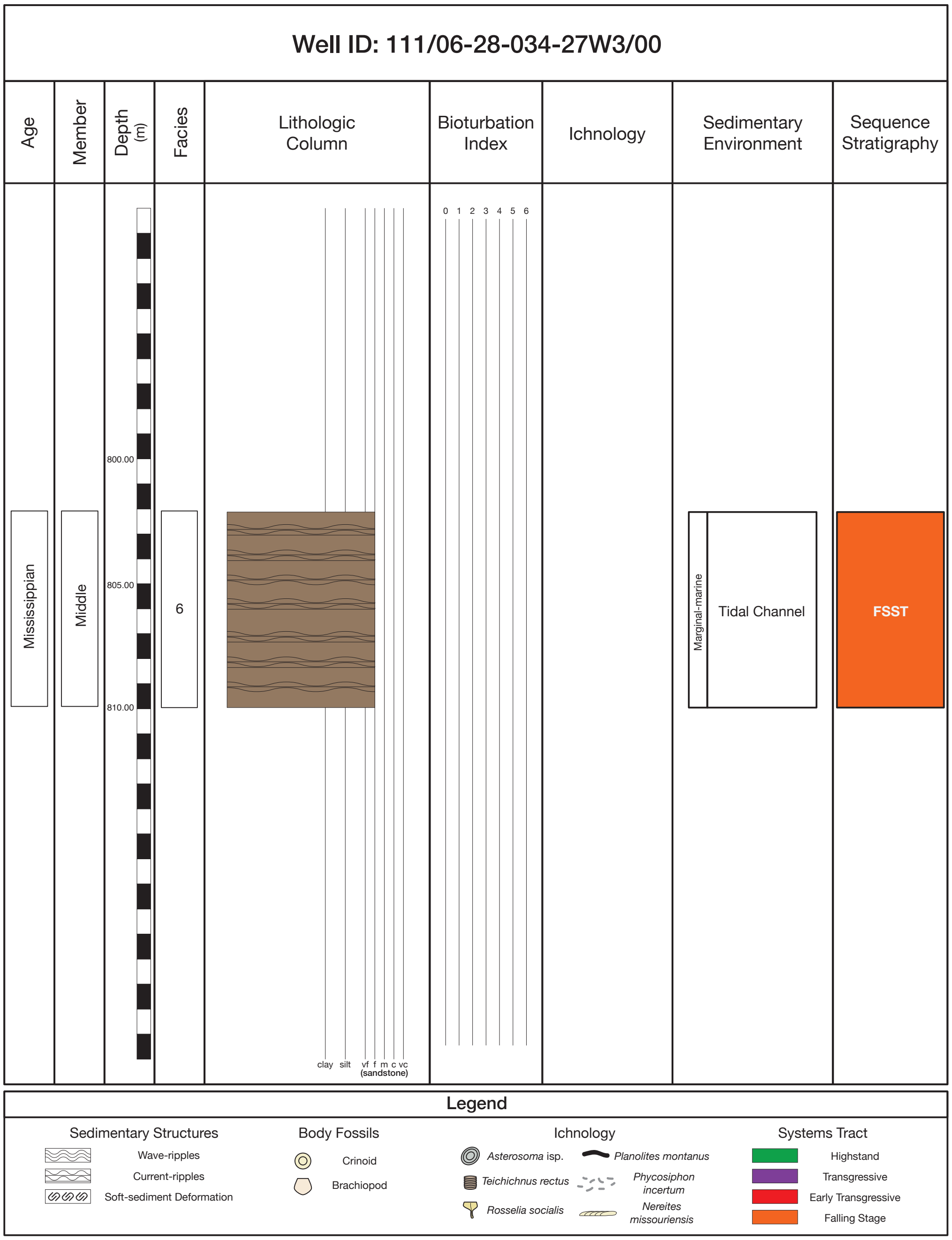
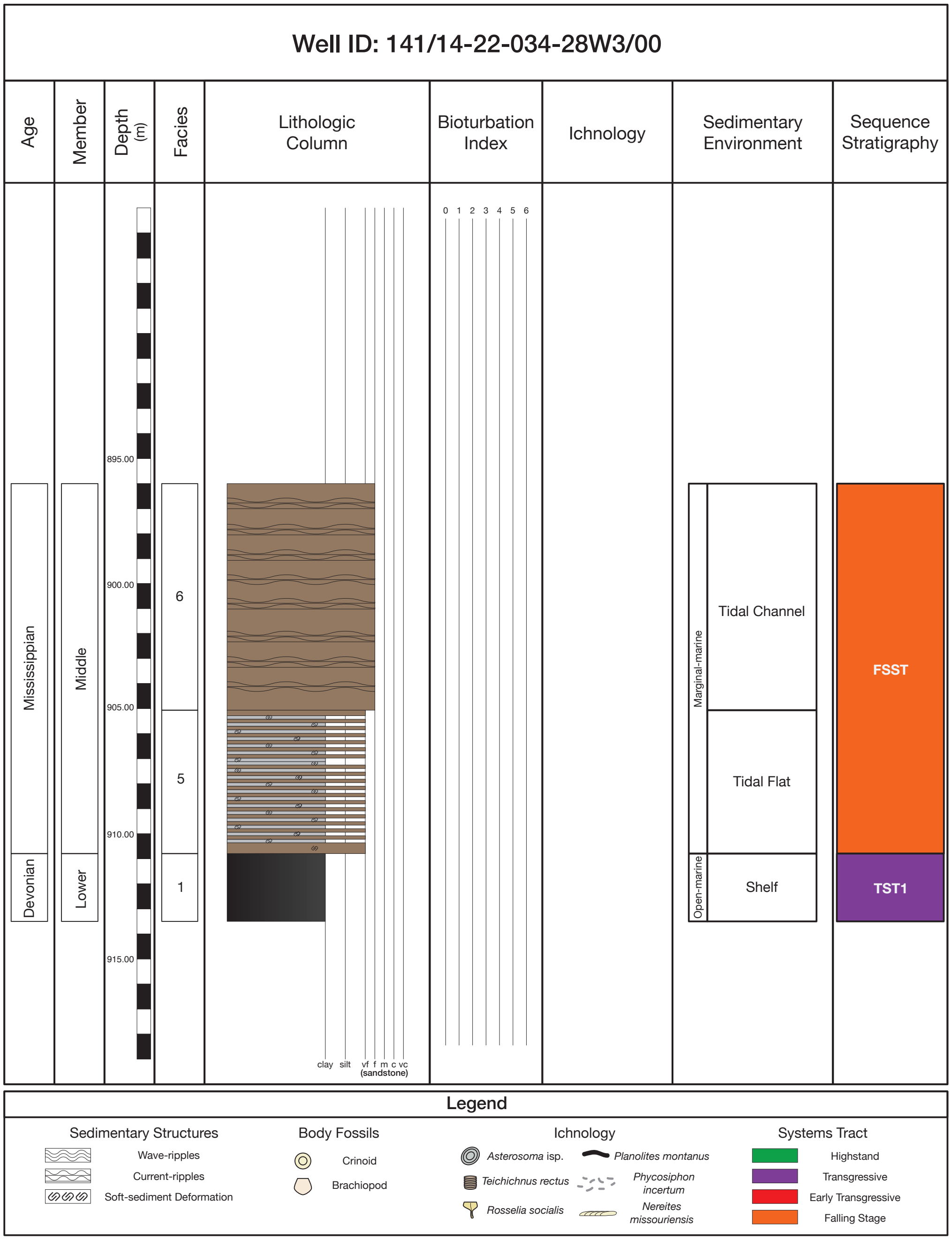
Brachiopod
Ichnology
Asterosoma isp.
Teichichnus rectus
Rosselia socialis
Planolites montanus
Phycosiphon incertum
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage

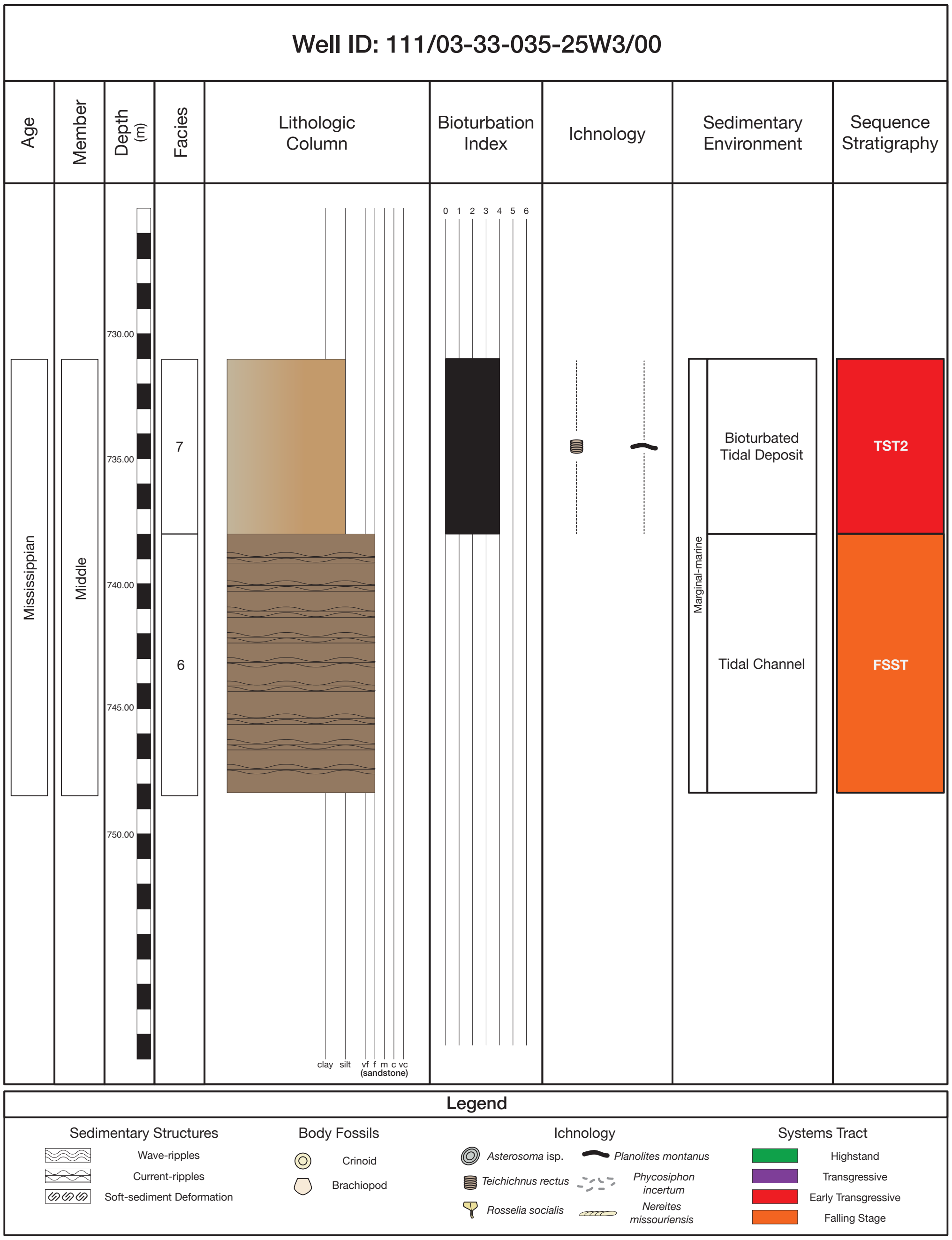

Well ID: 111/11-33-034-26W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
0 1 2 3 4 5 6
820.00
825.00
830.00
835.00
840.00
Mississippian
Middle
6
5
clay silt vf f m c vc
(sandstone)
Marginal-marine
Tidal Channel
Tidal Flat
FSST
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Teichichnus rectus
Rosselia socialis
Planolites montanus
Phycosiphon incertum
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage



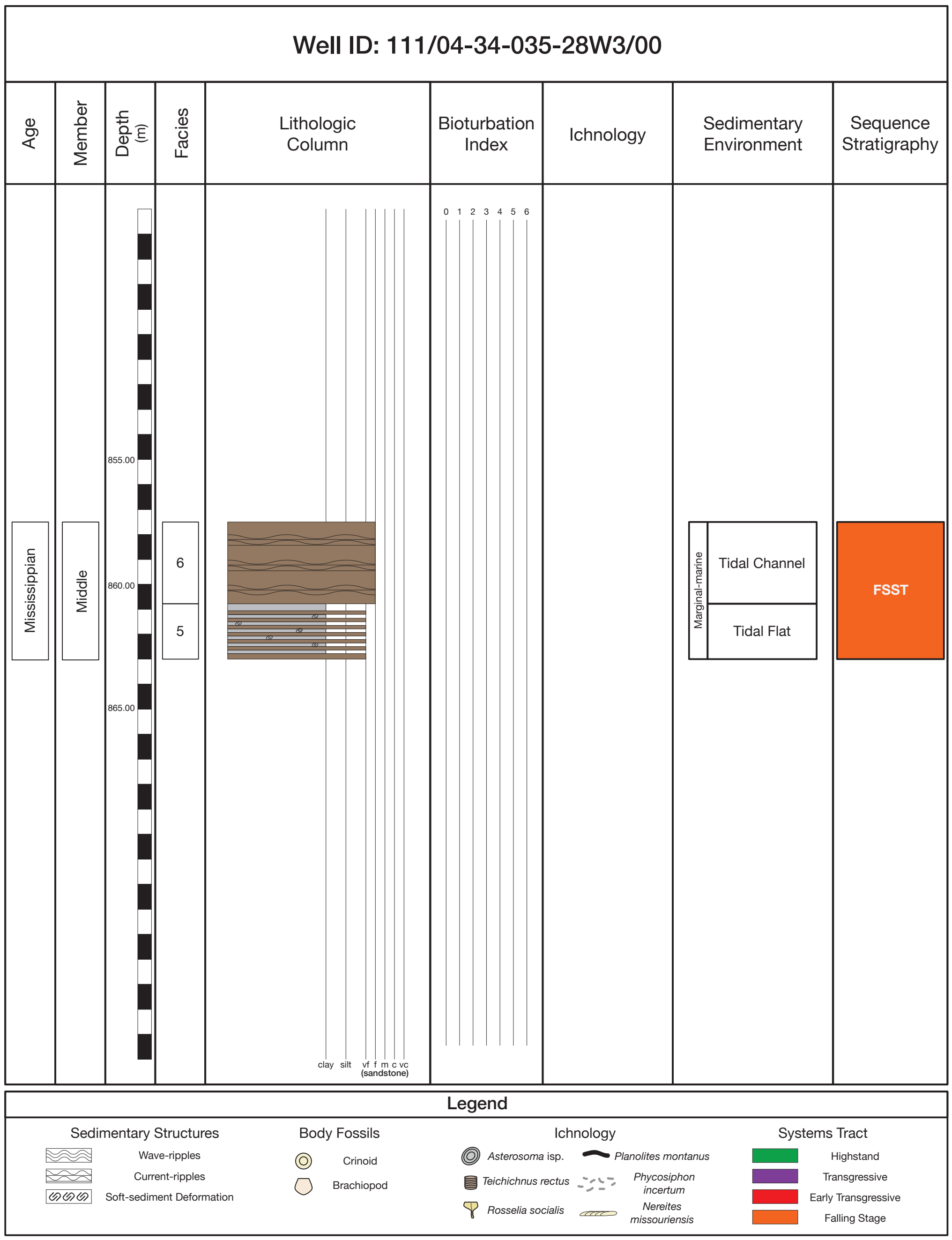
Well ID: 111/06-21-034-27W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
0 1 2 3 4 5 6
810.00
815.00
820.00
825.00
Mississippian
Middle
6
clay silt vf f m c vc (sandstone)
Marginal-marine
Tidal Channel
FSST
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage

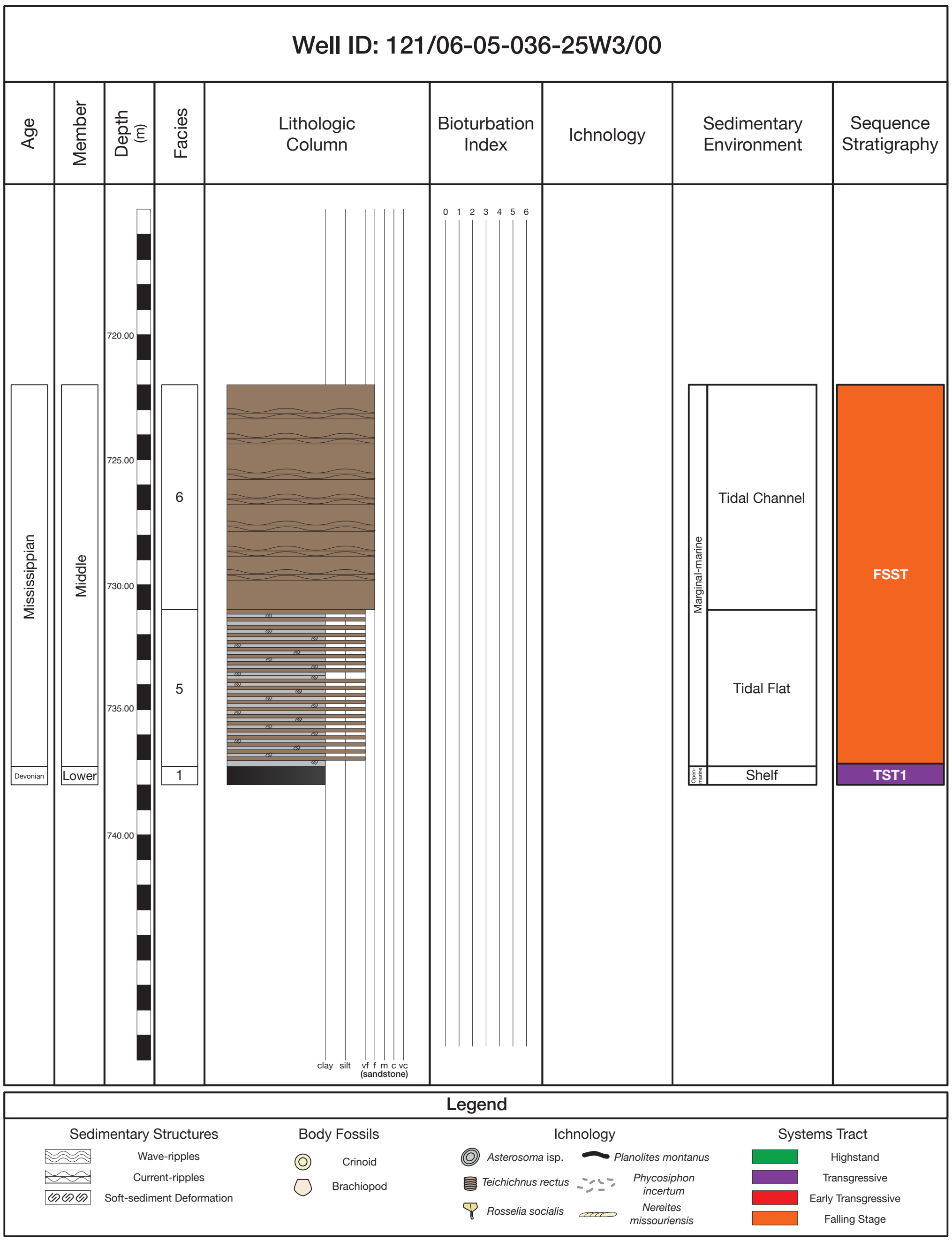

Well ID: 111/06-28-034-27W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
0 1 2 3 4 5 6
800.00
805.00
810.00
Mississippian
Middle
6
Marginal-marine
Tidal Channel
FSST
clay silt vf f m c vc
(sandstone)
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage


Well ID: 141/14-22-034-28W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
0 1 2 3 4 5 6
895.00
900.00
905.00
910.00
915.00
Mississippian
Devonian
Middle
Lower
6
5
1
clay silt vf f m c vc (sandstone)
Marginal-marine
Open-marine
Tidal Channel
Tidal Flat
Shelf
FSST
TST1
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Teichichnus rectus
Rosselia socialis
Planolites montanus
Phycosiphon incertum
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage

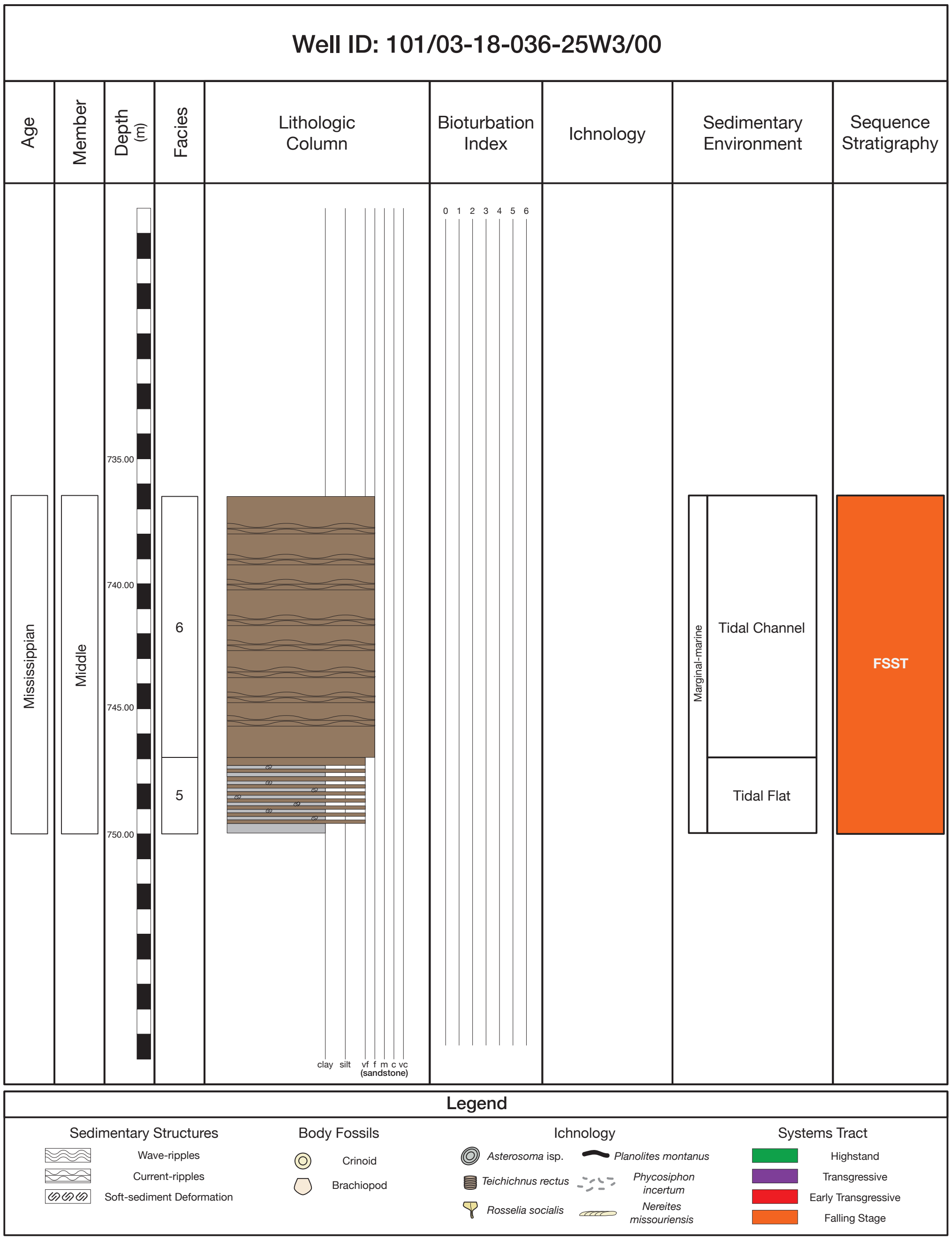


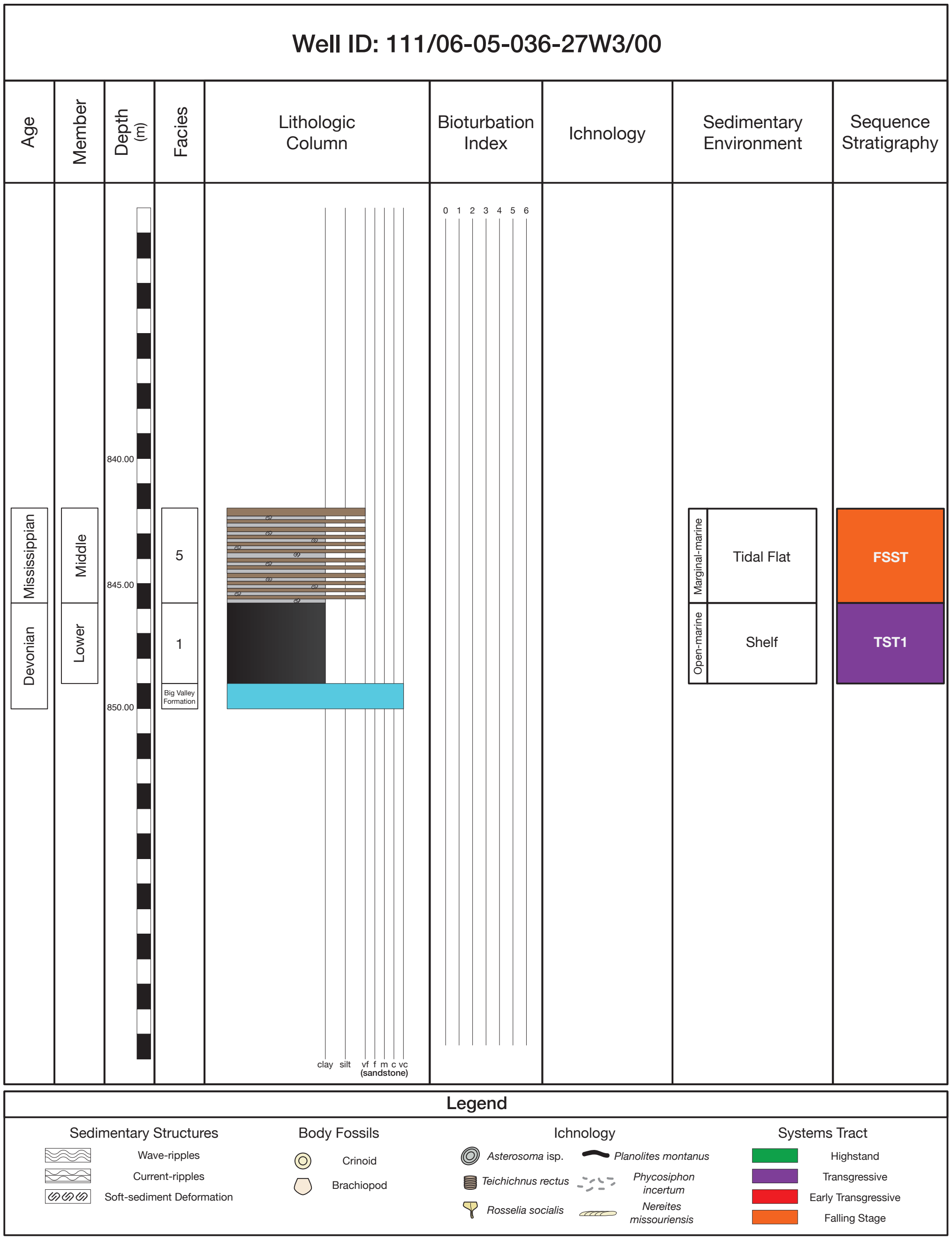
Well ID: 111/03-33-035-25W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Middle
730.00
735.00
740.00
745.00
750.00
7
6
clay silt vf f m c vc (sandstone)
0 1 2 3 4 5 6
Marginal-marine
Bioturbated Tidal Deposit
Tidal Channel
TST2
FSST
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage

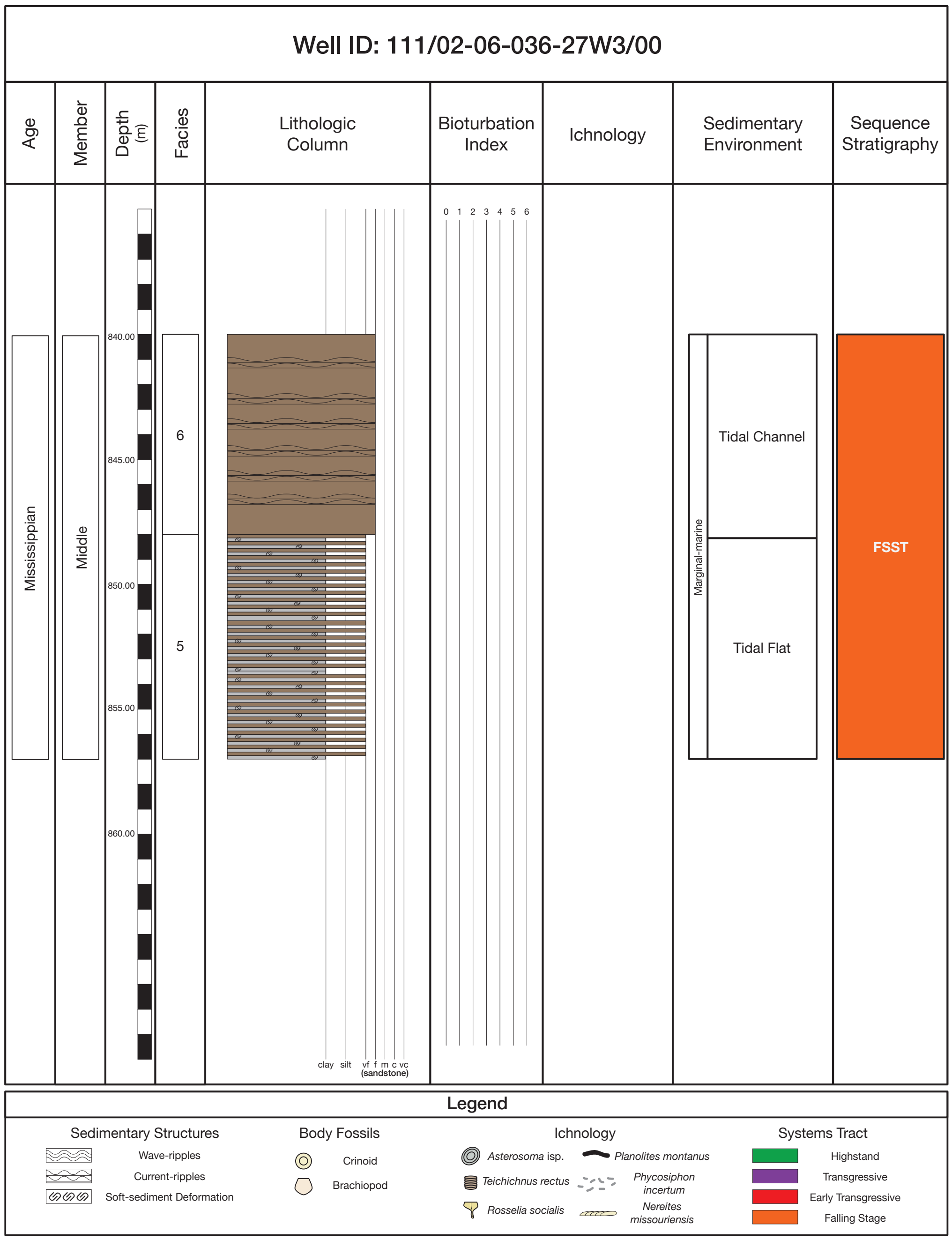

Well ID: 111/04-34-035-28W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
0 1 2 3 4 5 6
855.00
860.00
865.00
Mississippian
Middle
6
5
clay silt vf f m c vc (sandstone)
Marginal-marine
Tidal Channel
Tidal Flat
FSST
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage

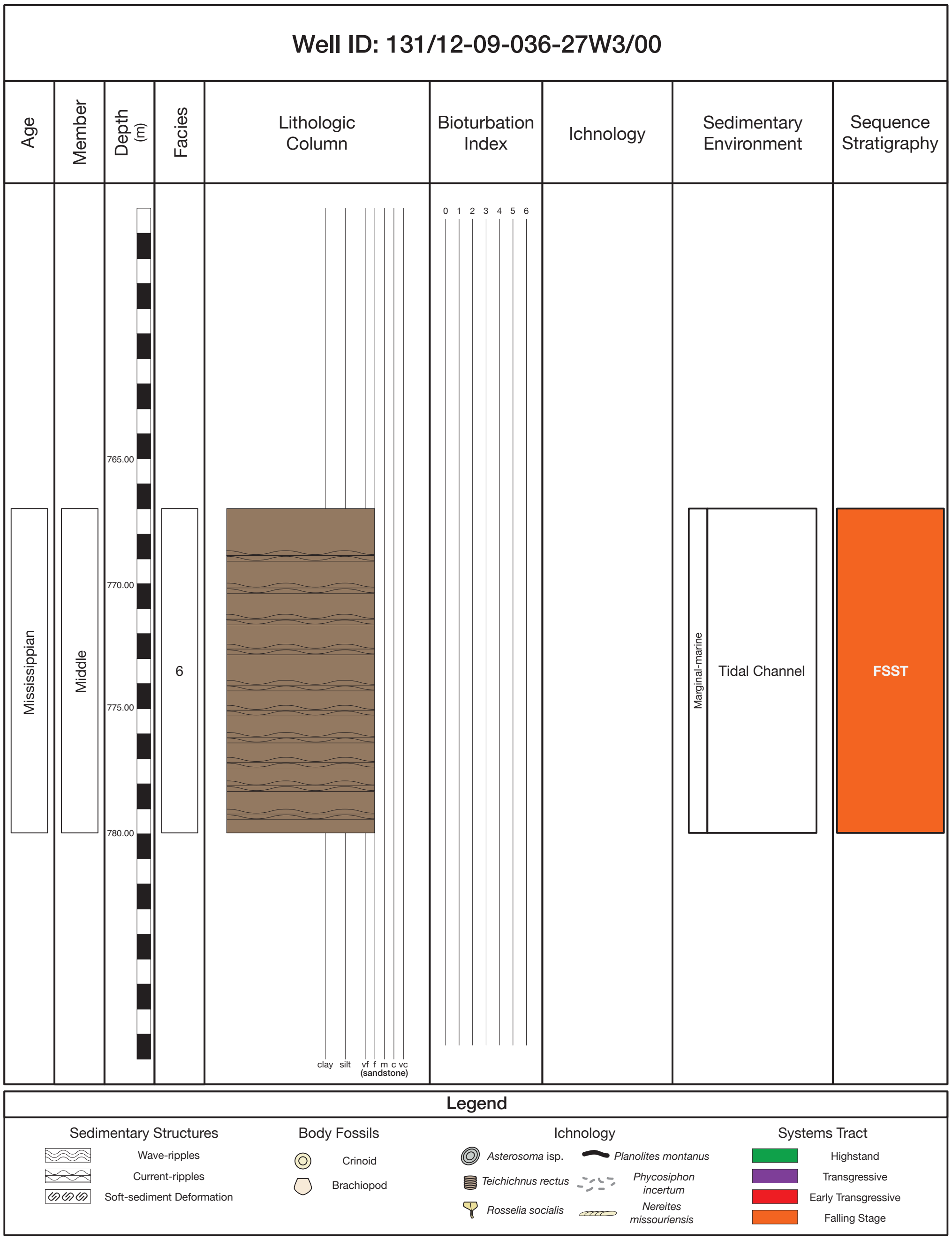


Well ID: 121/06-05-036-25W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Devonian
Middle
Lower
720.00
725.00
730.00
735.00
740.00
6
5
1
clay silt vf f m c vc
(sandstone)
0 1 2 3 4 5 6
Marginal-marine
Tidal Channel
Tidal Flat
Shelf
FSST
TST1
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage

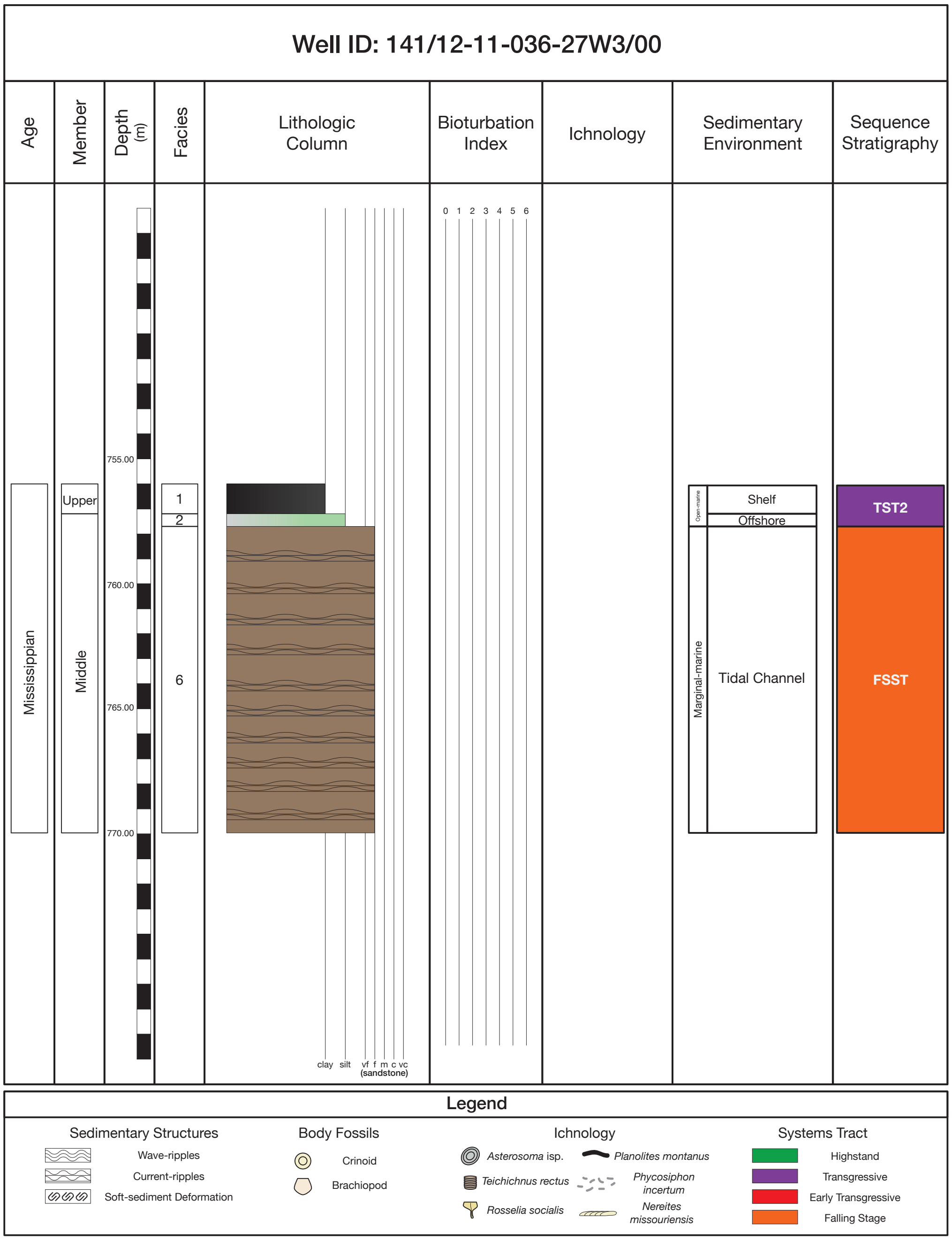

Well ID: 101/03-18-036-25W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
0 1 2 3 4 5 6
735.00
740.00
745.00
750.00
Mississippian
Middle
6
5
clay silt vf f m c vc (sandstone)
Marginal-marine
Tidal Channel
Tidal Flat
FSST
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Teichichnus rectus
Rosselia socialis
Planolites montanus
Phycosiphon incertum
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage


Well ID: 111/06-05-036-27W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
0 1 2 3 4 5 6
840.00
845.00
850.00
Mississippian
Devonian
Middle
Lower
5
1
Big Valley Formation
clay silt vf f m c vc (sandstone)
Marginal-marine
Open-marine
Tidal Flat
Shelf
FSST
TST1
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage

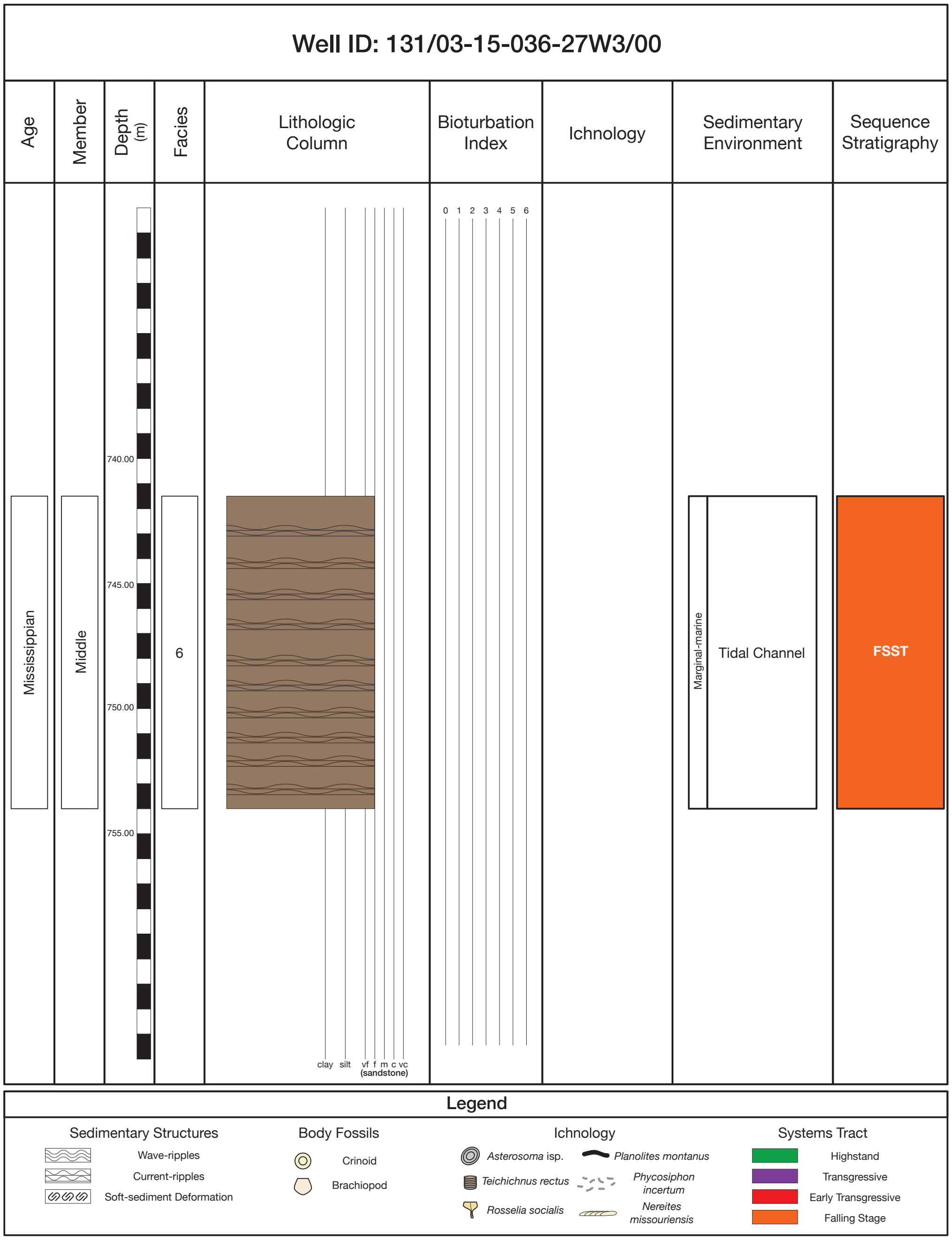

Well ID: 111/02-06-036-27W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Middle
840.00
845.00
850.00
855.00
860.00
6
5
clay silt vf f m c vc (sandstone)
0 1 2 3 4 5 6
Marginal-marine
Tidal Channel
Tidal Flat
FSST
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage

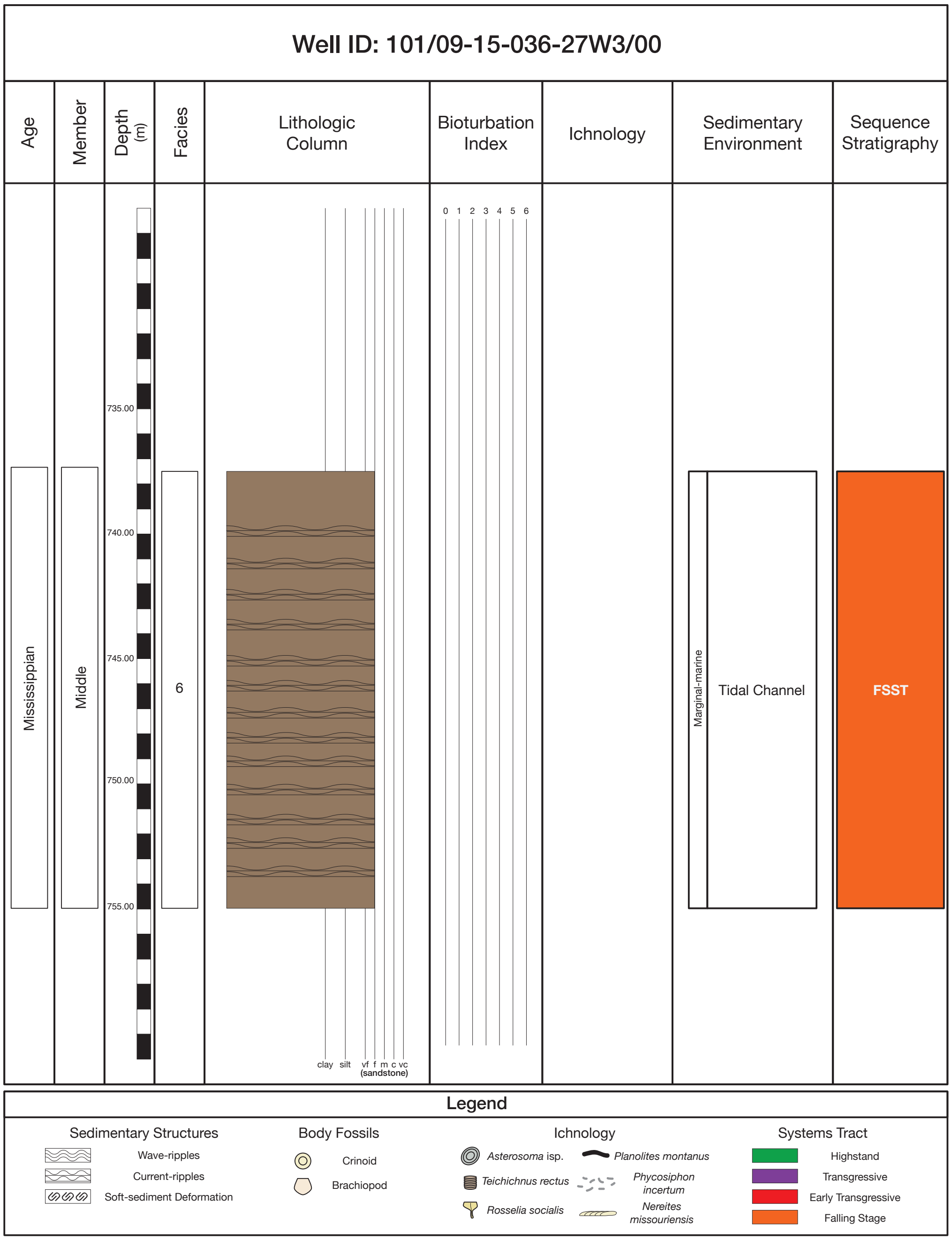


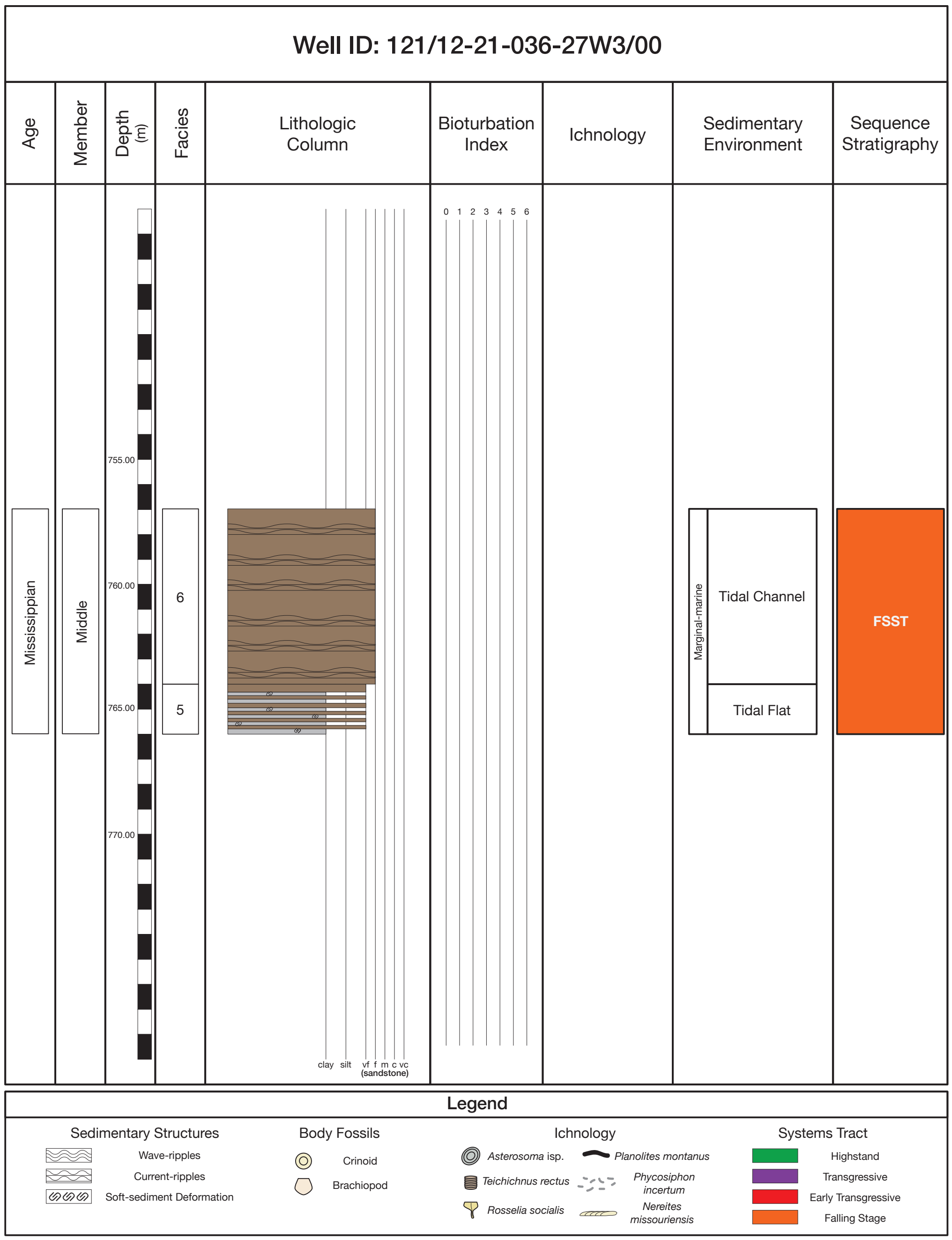
Well ID: 131/12-09-036-27W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
0 1 2 3 4 5 6
765.00
770.00
775.00
780.00
Mississippian
Middle
6
clay silt vf f m c vc (sandstone)
Marginal-marine
Tidal Channel
FSST
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Teichichnus rectus
Rosselia socialis
Planolites montanus
Phycosiphon incertum
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage



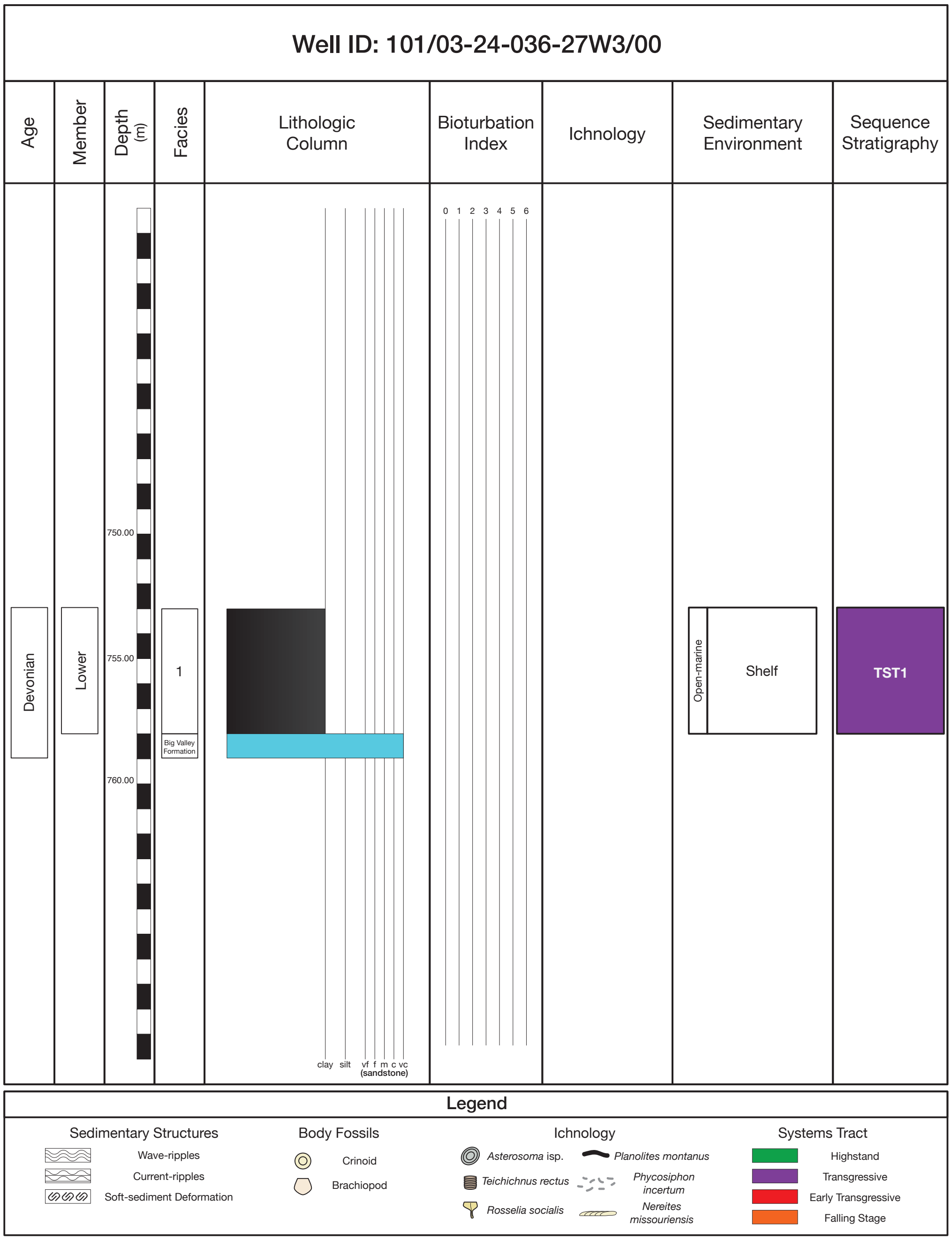
Well ID: 141/12-11-036-27W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Upper
Middle
755.00
760.00
765.00
770.00
1
2
6
0 1 2 3 4 5 6
clay silt vf f m c vc (sandstone)
Open-marine
Marginal-marine
Shelf
Offshore
Tidal Channel
TST2
FSST
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Teichichnus rectus
Rosselia socialis
Planolites montanus
Phycosiphon incertum
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage

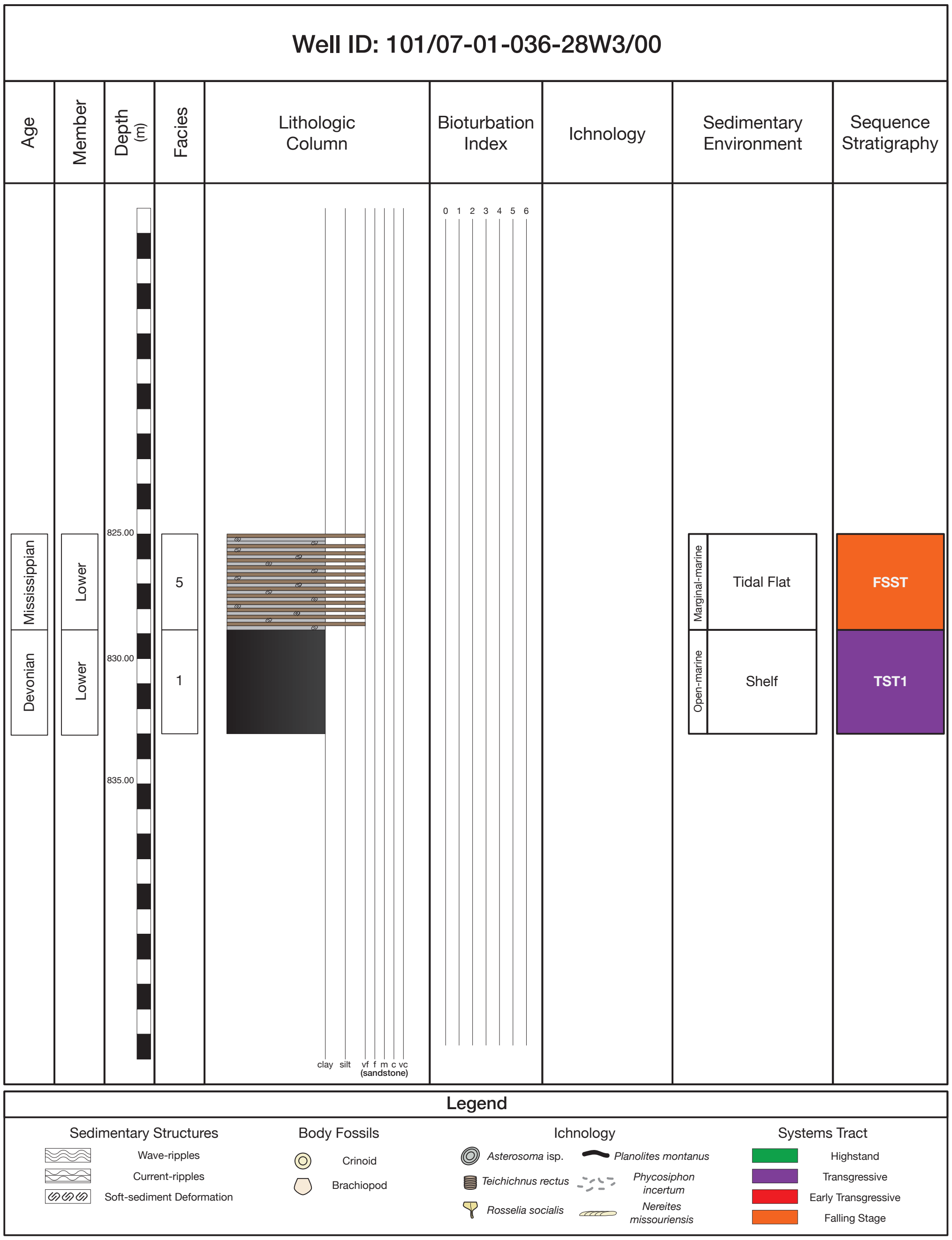

Well ID: 131/03-15-036-27W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
0 1 2 3 4 5 6
740.00
745.00
750.00
755.00
Mississippian
Middle
6
Marginal-marine
Tidal Channel
FSST
clay silt vf f m c vc (sandstone)
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Teichichnus rectus
Rosselia socialis
Planolites montanus
Phycosiphon incertum
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage


Well ID: 101/09-15-036-27W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
0 1 2 3 4 5 6
735.00
740.00
745.00
750.00
755.00
Mississippian
Middle
6
clay silt vf f m c vc (sandstone)
Marginal-marine
Tidal Channel
FSST
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage

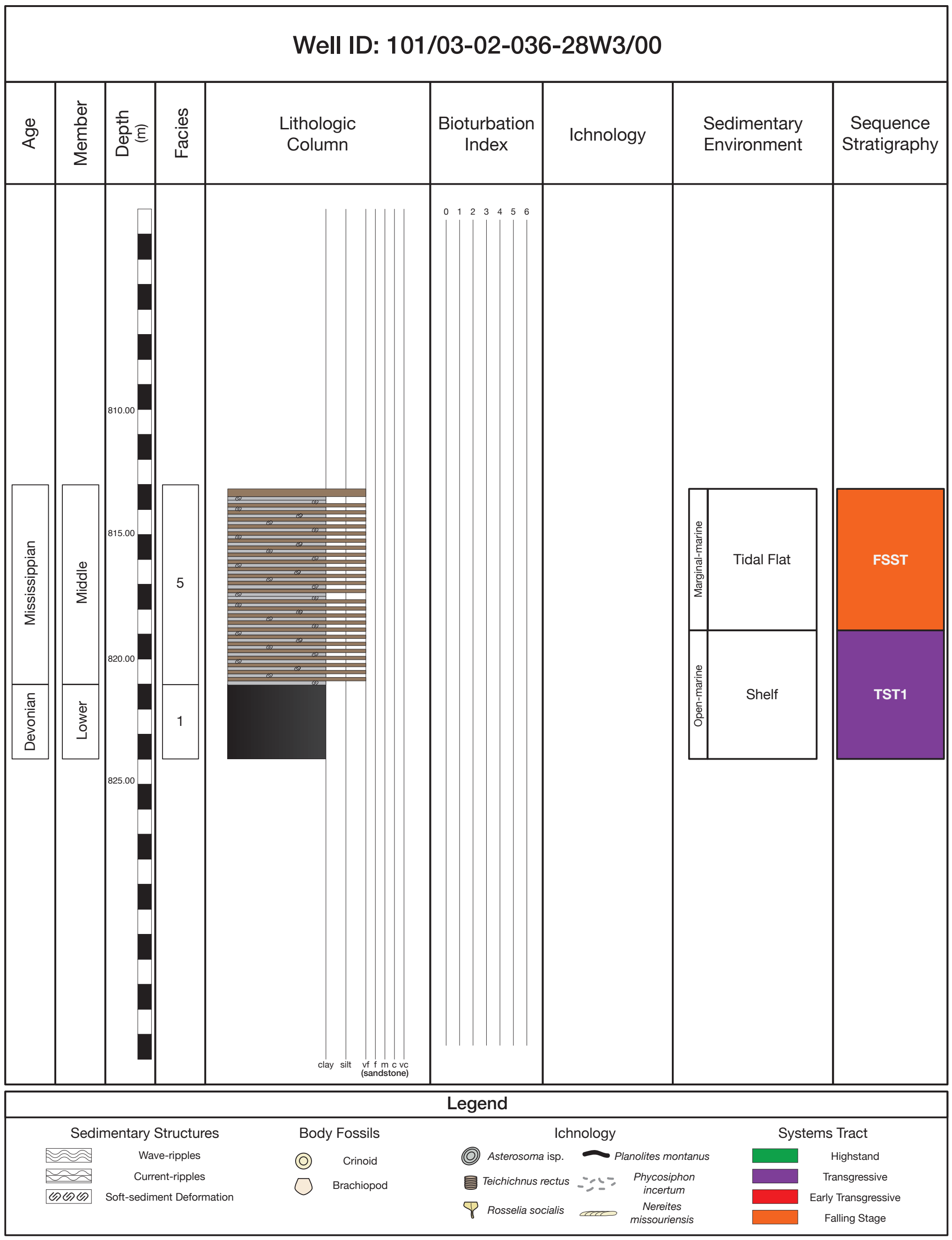


Well ID: 121/12-21-036-27W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
755.00
760.00
765.00
770.00
Mississippian
Middle
6
5
0 1 2 3 4 5 6
clay silt vf f m c vc (sandstone)
Marginal-marine
Tidal Channel
Tidal Flat
FSST
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Teichichnus rectus
Rosselia socialis
Planolites montanus
Phycosiphon incertum
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage

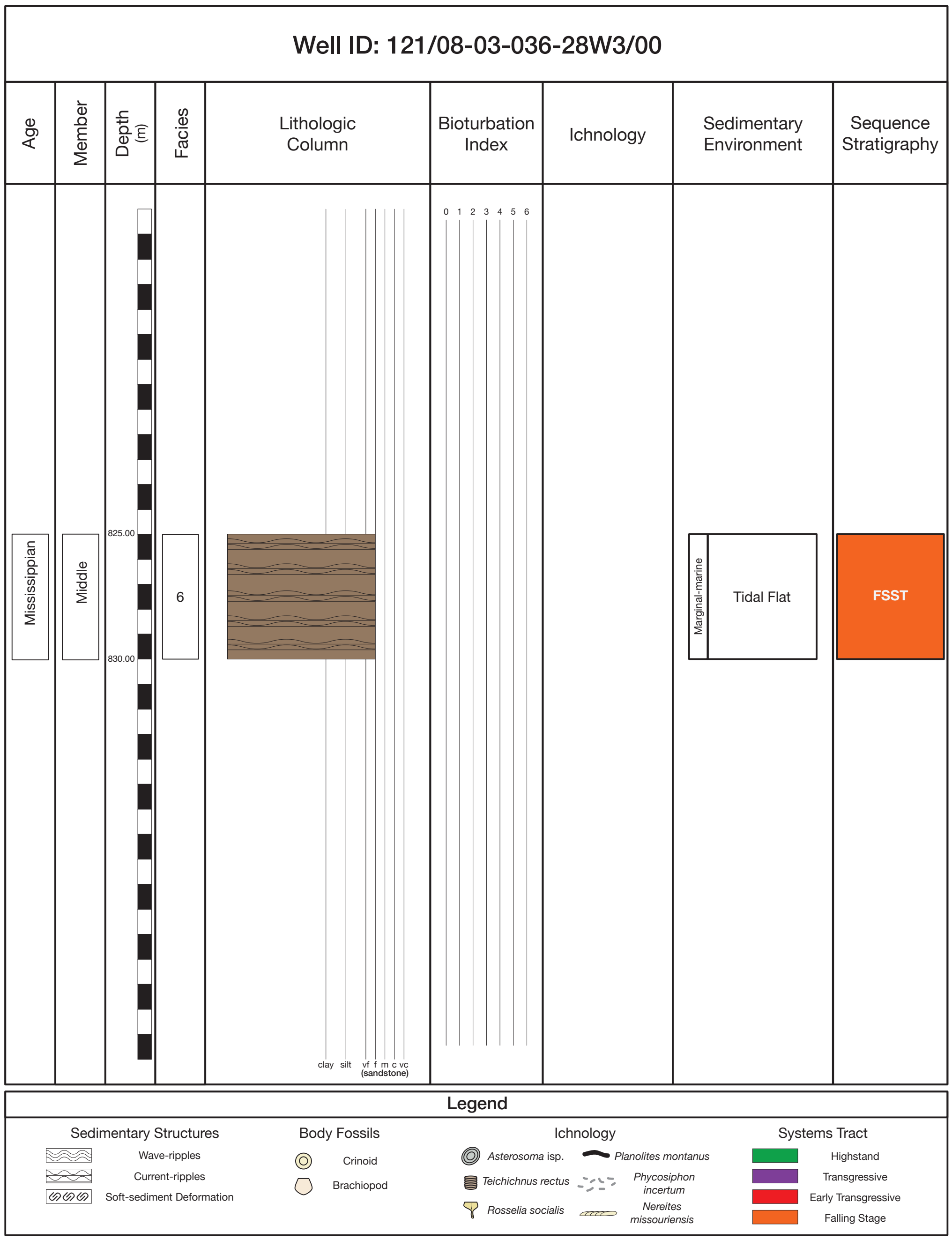

Well ID: 101/03-24-036-27W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
750.00
755.00
760.00
Devonian
Lower
1
Big Valley Formation
0 1 2 3 4 5 6
clay silt vf f m c vc
(sandstone)
Open-marine
Shelf
TST1
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage



Well ID: 101/07-01-036-28W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Devonian
Lower
Lower
825.00
830.00
835.00
5
1
0 1 2 3 4 5 6
clay silt vf f m c vc (sandstone)
Marginal-marine
Open-marine
Tidal Flat
Shelf
FSST
TST1
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage



Well ID: 101/03-02-036-28W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
0 1 2 3 4 5 6
810.00
815.00
820.00
825.00
Mississippian
Devonian
Middle
Lower
5
1
clay silt vf f m c vc (sandstone)
Marginal-marine
Tidal Flat
Open-marine
Shelf
FSST
TST1
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage


Well ID: 121/08-03-036-28W3/00
Age
Member
Depth (m)
Facies
Lithologic Column
Bioturbation Index
Ichnology
Sedimentary Environment
Sequence Stratigraphy
Mississippian
Middle
825.00
830.00
6
0 1 2 3 4 5 6
clay silt vf f m c vc (sandstone)
Marginal-marine
Tidal Flat
FSST
Legend
Sedimentary Structures
Wave-ripples
Current-ripples
Soft-sediment Deformation
Body Fossils
Crinoid
Brachiopod
Ichnology
Asterosoma isp.
Planolites montanus
Teichichnus rectus
Phycosiphon incertum
Rosselia socialis
Nereites missouriensis
Systems Tract
Highstand
Transgressive
Early Transgressive
Falling Stage

APPENDIX B

FACIES AND FACIES ASSOCIATION TOPS 1

Well I.D.	KB (m)	B. Valley TVD (m)	F1 Lower TVD (m)	F2/F3 Low. TVD (m)	F2/F3 Low. ISO (m)	F4 TVD (m)	F4 ISO (m)	FA2 TVD (m)	FA2 ISO (m)	F2 Up. TVD (m)	F2 Up. ISO (m)
101/07-31-028-24W3/00	697.7	915.1	903.8	897.4	6.4		0		0		0
131/16-33-029-22W3/00	707.4	903.4	894.9		0	892.9	2		0		0
102/11-34-029-25W3/00	704.8	888.1	881.8	876.7	5.1	876	0.7		0	862.6	13.4
101/06-25-029-27W3/00	701.0	915.0	911.2		0		0	892.2	19		0
101/11-18-029-28W3/00	721.9	906.0	901.5		0		0		0	870.8	30.7
111/15-33-029-28W3/00	670.8	850.0	847.5	839.9	7.6		0	808.3	31.6	807.5	0.8
101/06-30-030-21W3/00	674.2	841.6	835.5		0	834.2	1.3	817.9	16.3	815.2	2.7
101/12-30-030-21W3/00	675.3	840.0	834.0		0	832.6	1.4	812.5	20.1		0
111/13-36-030-21W3/00	676.4		835.4		0	834.1	1.3	817.3	16.8	816.1	1.2
141/07-08-030-22W3/00	706.9	886.8	879.7		0	878.6	1.1	863.4	15.2		0
111/13-12-030-22W3/00	695.6	877.6	870.1		0	866.2	3.9	855.2	11	853.5	1.7
101/11-22-030-22W3/00	686.3	860.8	855.4		0	853.9	1.5	842.4	11.5	839.1	3.3
111/10-22-030-23W3/00	705.4	874.3	868.3		0	864.9	3.4	852.1	12.8	850.8	1.3
101/12-25-030-23W3/00	702.4	869.1	863.2		0	860.4	2.8	849.5	10.9		0
111/14-28-030-23W3/00	699.8	862.6	856.5		0	853.2	3.3	837.2	16		0
111/01-29-030-23W3/00	693.4	847.6	841.6		0	839.5	2.1	823.9	15.6		0
111/06-31-030-23W3/00	696.2	844.2	836.9		0	832.6	4.3	815.2	17.4	814.2	1
131/14-31-030-23W3/00	699.0	845.2	839.1		0	835.9	3.2	817.9	18	817.1	0.8
131/14-32-030-23W3/00	703.7	849.2	842.6		0	840.5	2.1	820.5	20		0
101/03-34-030-23W3/00	700.7	860.5	855.9		0	853.8	2.1	835.6	18.2		0
111/12-35-030-23W3/00	691.4	849.1	843.5		0	840.9	2.6	831.4	9.5	830.4	1
141/06-02-030-24W3/00	693.0	869.5	863.0		0		0	849.9	13.1	848.1	1.8
141/07-34-030-24W3/00	711.7	867.0	860.5		0	859.2	1.3	854.6	4.6	852.5	2.1
131/16-36-030-24W3/00	702.7	847.5	840.5		0	839.3	1.2	819.5	19.8		0
111/11-01-030-25W3/00	709.5	890.0	884.0	881.0	3		0	864.5	16.5		0
121/07-11-030-25W3/03	717.1	893.0	886.8	884.3	2.5		0	879.6	4.7	878.2	1.4
111/14-35-030-25W3/00	682.2	828.0	822.9		0		0	799.1	23.8		0
101/06-01-030-26W3/00	720.7	925.0	919.0	910.6	8.4		0	892.1	18.5		0
131/05-04-030-26W3/00	731.5	917.5	912.6	906.4	6.2		0	900.6	5.8	898.5	2.1
111/15-07-030-26W3/00	705.0	879.0	875.0	870.2	4.8		0	863.5	6.7	862.1	1.4
112/09-10-030-26W3/00	719.7	902.3	897.0	885.5	11.5		0	879.7	5.8	877.5	2.2
111/16-16-030-26W3/00	730.8	896.0	891.5	886.9	4.6		0	874.1	12.8		0
111/15-18-030-26W3/00	698.6	884.0	879.2	875.4	3.8		0	864.1	11.3	863.4	0.7
111/14-21-030-26W3/00	719.5	888.3	884.6	880.0	4.6		0	866.3	13.7		0
111/11-26-030-26W3/00	723.8	886.0	881.0	878.2	2.8		0	875.6	2.6	872	3.6
111/07-28-030-26W3/00	723.8	891.8	887.5	882.7	4.8		0	870.3	12.4		0
131/10-28-030-26W3/00	711.7	880.0	875.2		0	875.1	0.1	862.7	12.4		0
111/12-29-030-26W3/00	701.2	867.0	862.8	860.9	1.9		0	847.4	13.5		0
141/09-30-030-26W3/00	704.0	876.1	872.9	869.6	3.3		0	859.1	10.5		0
131/08-31-030-26W3/00	705.1	872.5	868.2	865.2	3		0	854.3	10.9		0
141/11-33-030-26W3/00	717.7	878.8	874.7		0	873.2	1.5	860	13.2		0
111/15-34-030-26W3/00	718.7	880.9	876.4		0	875.5	0.9	861.5	14		0
111/07-02-030-27W3/00	716.0	900.0	895.8	886.0	9.8		0	873.6	12.4	871.6	2
121/07-06-030-27W3/00	712.4	888.0	884.3	862.6	21.7		0	849.6	13		0
120/11-07-030-27W3/00	702.0	870.3	867.1	854.5	12.6		0		0	847.7	6.8
111/10-13-030-27W3/02	707.1	889.8	885.2	879.9	5.3		0	873.5	6.4	871.9	1.6
111/08-18-030-27W3/00	697.5	871.0	867.5	848.3	19.2		0		0	846.5	1.8
141/11-19-030-27W3/00	694.9	876.8	872.8	865.8	7		0	855.5	10.3	854.7	0.8
131/16-20-030-27W3/00	702.4	875.2	871.3	865.4	5.9		0	846.7	18.7		0
111/06-24-030-27W3/00	706.0	897.0	892.5	888.4	4.1		0	874.2	14.2		0
131/11-25-030-27W3/00	713.5	886.0	882.1	878.1	4		0	870	8.1	869.3	0.7
101/16-29-030-27W3/00	704.2	868.8	865.4	860.9	4.5		0	848.2	12.7	847.3	0.9
111/14-31-030-27W3/02	703.6	870.1	866.1	853.6	12.5		0	843.6	10		0
121/06-01-030-28W3/00	692.2	866.7	863.2	845.0	18.2		0	841.1	3.9	838.8	2.3
131/01-04-030-28W3/00	681.8	856.6	853.4	827.9	25.5		0	814.8	13.1		0
111/03-04-030-28W3/00	678.4	855.0	851.9	845.8	6.1		0	810	35.8		0
111/12-06-030-28W3/02	678.7	855.8	853.0	846.9	6.1		0	833.7	13.2	831.4	2.3
111/15-08-030-28W3/00	680.1	841.3	837.6		0		0	812.4	25.2		0
141/10-09-030-28W3/00	685.3	855.5	852.3	844.7	7.6		0	825.5	19.2	823.5	2
141/08-10-030-28W3/03	695.8	862.0	859.4	840.5	18.9		0	819.6	20.9		0
111/16-12-030-28W3/00	692.2	865.9	862.8	848.2	14.6		0	835.3	12.9	834.3	1
121/15-13-030-28W3/00	690.1	857.5	854.4	841.9	12.5		0	829.2	12.7	827.8	1.4
101/11-14-030-28W3/00	697.7	872.0	869.0	857.1	11.9		0	842.2	14.9	840.7	1.5
121/14-16-030-28W3/00	697.3	881.0	878.0	868.5	9.5		0	854.4	14.1	853.1	1.3
111/02-18-030-28W3/00	684.6	857.9	855.0	845.4	9.6		0	831.5	13.9	829.4	2.1
111/15-21-030-28W3/00	684.9	848.1	845.0	837.2	7.8		0	823	14.2	821.3	1.7
111/04-23-030-28W3/00	705.2	871.3	868.6	852.4	16.2		0	837.9	14.5		0
141/06-24-030-28W3/00	696.9	871.2	868.5	858.5	10		0	844.2	14.3	842.8	1.4
111/08-25-030-28W3/00	696.5	868.3	864.5	859.9	4.6		0	840.2	19.7		0
141/12-26-030-28W3/02	697.7	868.0	864.5	856.7	7.8		0	843.1	13.6	841.1	2
111/09-31-030-28W3/00	690.9	851.9	848.5	841.8	6.7		0	835.4	6.4	833.4	2
101/10-32-030-28W3/00	704.4	863.8	861.4		0		0		0		0
121/10-32-030-28W3/00	701.7	862.4	860.1	854.3	5.8		0	845.5	8.8	843.5	2
111/06-36-030-28W3/00	693.3	862.5	859.1	848.9	10.2		0	835.4	13.5	833.9	1.5
121/02-02-030-29W3/00	706.1	879.6	876.0	856.1	19.9		0	844.8	11.3	843.6	1.2
131/10-03-030-29W3/00	730.0	895.0	892.1	877.1	15		0	867.7	9.4	865.5	2.2
101/10-10-030-29W3/00	709.2	874.0	870.0	861.1	8.9		0	842.5	18.6		0
131/06-13-030-29W3/00	700.7	880.0	876.2	852.9	23.3		0	851.1	1.8	850	1.1

Well I.D.	KB (m)	B. Valley TVD (m)	F1 Lower TVD (m)	F2/F3 Low. TVD (m)	F2/F3 Low. ISO (m)	F4 TVD (m)	F4 ISO (m)	FA2 TVD (m)	FA2 ISO (m)	F2 Up. TVD (m)	F2 Up. ISO (m)
111/08-27-030-29W3/00	711.1	876.1	873.0	859.5	13.5		0	853.6	5.9	850.6	3
111/14-34-030-29W3/00	723.9	897.1	894.6	885.2	9.4		0	878.2	7	876.2	2
131/08-36-030-29W3/00	683.4	841.5	838.0	831.6	6.4		0	819.5	12.1	817.9	1.6
111/13-23-031-20W3/03	708.1	861.9	852.2		0		0	836.5	15.7	836	0.5
102/12-21-031-21W3/00	684.8	831.6	826.1		0	824.9	1.2	812.4	12.5		0
121/09-35-031-21W3/00	698.2	839.6	835.6		0	833.4	2.2	826	7.4	825.1	0.9
111/11-28-031-22W3/00	690.7	819.1	811.2		0	809.4	1.8	795.9	13.5	794.4	1.5
111/13-29-031-22W3/00	694.3	832.2	824.9		0	824.1	0.8	805.4	18.7		0
111/06-33-031-22W3/00	690.6	818.0	812.3		0		0	789.3	23		0
121/07-34-031-22W3/02	687.1	815.0	809.1		0		0	792.7	16.4	791.5	1.2
121/01-04-031-23W3/00	700.1	847.8	840.7		0	838.9	1.8	819.6	19.3		0
141/04-04-031-23W3/00	699.4	839.8	833.7		0	832	1.7	816.6	15.4	815.1	1.5
111/16-07-031-23W3/00	705.4	838.0	832.5		0	830.7	1.8	824.1	6.6	822.6	1.5
141/01-08-031-23W3/00	698.5	840.9	834.9		0	832.6	2.3	820.3	12.3	819	1.3
121/02-08-031-23W3/00	697.7	835.7	829.5		0		0	816.2	13.3	815.4	0.8
121/09-09-031-23W3/00	696.0	831.6	825.3		0	824	1.3	810.7	13.3		0
121/01-10-031-23W3/00	690.2	827.6	821.5		0		0	807.4	14.1		0
141/06-10-031-23W3/00	694.0	834.3	828.0		0		0	815.9	12.1		0
121/16-10-031-23W3/00	692.6	829.2	823.2		0		0	811.1	12.1	809.8	1.3
121/10-11-031-23W3/00	691.4	833.1	827.6		0	825.4	2.2	816.3	9.1		0
121/10-12-031-23W3/00	688.4	850.6	844.7	843.3	1.4		0	829.1	14.2		0
121/13-12-031-23W3/00	690.4		841.3		0		0		0		0
141/04-14-031-23W3/00	691.7	823.2	818.5		0		0		0		0
121/13-14-031-23W3/00	690.4	822.9	817.2		0	816.7	0.5	801.3	15.4		0
141/02-15-031-23W3/00	693.5	831.9	824.8		0	824.4	0.4	813.1	11.3	811.8	1.3
121/05-15-031-23W3/00	699.5	838.0	832.0		0		0	819.5	12.5	818.2	1.3
141/06-15-031-23W3/00	693.7	831.1	824.2		0	822.4	1.8	810.3	12.1	809.3	1
121/09-16-031-23W3/00	698.9	832.2	825.6		0		0	817.4	8.2	814	3.4
121/14-17-031-23W3/00	709.0	844.9	842.3		0	839.4	2.9		0		0
121/16-17-031-23W3/00	704.7	835.2	828.1		0	827	1.1	821.5	5.5	819.5	2
141/10-18-031-23W3/00	712.9	852.5	847.0		0	844.9	2.1	832.9	12	831.9	1
121/07-21-031-23W3/00	699.2	824.5	817.5		0	815.7	1.8	812.1	3.6	809.7	2.4
101/01-23-031-23W3/00	693.7	849.2	843.9		0		0	830.6	13.3		0
122/02-28-031-23W3/00	700.1	821.1	815.0		0	813.3	1.7	799.9	13.4	798.6	1.3
101/13-28-031-23W3/02	704.7	822.4	812.9		0	810.9	2		0		0
121/04-30-031-23W3/00	720.2	845.3	839.7		0	839	0.7	821	18		0
191/02-32-031-23W3/00	704.9	829.0	822.1		0		0	799.8	22.3	799.3	0.5
111/08-04-031-24W3/00	695.7	841.2	835.6		0	834.9	0.7	824.2	10.7	821.5	2.7
111/09-05-031-24W3/00	688.1	834.8	829.6		0	828.1	1.5	807.5	20.6		0
121/08-13-031-24W3/00	689.8	850.8	843.0		0	841.8	1.2	830.1	11.7	825.8	4.3
111/05-15-031-24W3/00	691.3	825.1	819.9		0	819.3	0.6	805.4	13.9	804.3	1.1
131/09-18-031-24W3/00	702.2	840.8	835.3		0		0	824.4	10.9	822.8	1.6
101/06-22-031-24W3/00	699.3	837.7	832.9		0	832.3	0.6	820	12.3	818	2
121/14-24-031-24W3/00	714.8		836.5		0		0		0	820.4	16.1
111/12-30-031-24W3/00	673.5	794.7	790.6		0		0	775.8	14.8	773.9	1.9
141/01-36-031-24W3/00	711.4	843.1	837.0		0	836.4	0.6	828.6	7.8	827.1	1.5
111/11-03-031-25W3/00	699.4	847.5	842.9		0		0	825.3	17.6		0
111/07-17-031-25W3/00	716.7	860.5	856.1	851.8	4.3		0	837.5	14.3		0
131/01-20-031-25W3/00	717.9	854.8	850.0		0		0	835.1	14.9		0
101/03-33-031-25W3/00	712.7	838.0	833.7	830.0	3.7		0	820.8	9.2		0
131/12-33-031-25W3/00	712.3	845.8	841.2	839.8	1.4		0	838.8	1	837.1	1.7
101/08-36-031-25W3/00	701.1	825.7	821.9		0		0	802.3	19.6		0
111/14-02-031-26W3/00	720.3	879.2	874.8		0	873.4	1.4	860.7	12.7	859.5	1.2
121/11-05-031-26W3/00	711.6	873.2	869.2	866.7	2.5	865	1.7	850	15		0
131/11-06-031-26W3/00	721.8	883.6	879.3	877.0	2.3	875.8	1.2	862.7	13.1		0
101/14-07-031-26W3/00	701.6	869.2	865.4		0	863.4	2	848.8	14.6		0
131/15-09-031-26W3/00	715.8	865.0	861.2		0	860.3	0.9	846.5	13.8		0
141/02-11-031-26W3/00	724.4	882.5	878.3		0		0	862.3	16		0
131/05-15-031-26W3/00	715.2	864.4	860.5		0	859.9	0.6	845.5	14.4		0
131/10-15-031-26W3/00	710.0	854.7	851.2		0	850.2	1	836.8	13.4	836.1	0.7
111/05-18-031-26W3/00	708.5	889.2	884.3		0	883.3	1	869.9	13.4	867	2.9
111/13-21-031-26W3/00	722.5	878.0	873.4		0	872.5	0.9	855.5	17		0
111/15-22-031-26W3/00	710.8	852.7	848.3		0		0	840.4	7.9	839	1.4
101/04-28-031-26W3/00	721.9	894.3	890.0		0		0	870.8	19.2		0
111/03-01-031-27W3/00	701.4	863.3	859.7	856.5	3.2		0	848.6	7.9	847.3	1.3
131/06-03-031-27W3/00	724.2	909.9	906.9	900.4	6.5		0	881.9	18.5		0
131/11-04-031-27W3/00	713.0	897.0	893.1	883.7	9.4		0	868.3	15.4		0
111/03-06-031-27W3/00	715.7	889.6	886.3	877.2	9.1		0	865.2	12	864.2	1
111/01-07-031-27W3/00	730.9	890.5	887.3	885.5	1.8	884.4	1.1	867.9	16.5	866.4	1.5
121/14-07-031-27W3/00	727.5	902.3	899.0	892.0	7		0	876.9	15.1	875.6	1.3
121/06-10-031-27W3/00	706.0	882.8	878.9		0		0		0		0
121/11-11-031-27W3/00	717.6	901.2	897.2	894.4	2.8		0	876.4	18	874.9	1.5
101/06-13-031-27W3/00	699.5	859.2	855.5	853.4	2.1		0	832.9	20.5		0
141/02-14-031-27W3/00	699.7	881.8	878.0	866.7	11.3		0	852.9	13.8		0
111/14-14-031-27W3/00	697.9	863.5	859.0	854.9	4.1		0	851.2	3.7	849	2.2
131/06-15-031-27W3/00	692.5	855.0	851.4	846.6	4.8		0	845	1.6	843.6	1.4
121/15-15-031-27W3/00	690.7	860.8	857.1	852.1	5		0	844.4	7.7	842.1	2.3
111/13-16-031-27W3/00	712.0	879.0	874.7	866.1	8.6		0	849.9	16.2		0

Well I.D.	KB (m)	B. Valley TVD (m)	F1 Lower TVD (m)	F2/F3 Low. TVD (m)	F2/F3 Low. ISO (m)	F4 TVD (m)	F4 ISO (m)	FA2 TVD (m)	FA2 ISO (m)	F2 Up. TVD (m)	F2 Up. ISO (m)
131/06-17-031-27W3/00	710.9	893.8	890.6	884.3	6.3		0	865.7	18.6		0
121/03-18-031-27W3/00	724.1	895.7	891.6	885.3	6.3		0	869.4	15.9		0
101/13-19-031-27W3/00	712.3	874.8	872.6	867.0	5.6		0	845	22		0
112/06-21-031-27W3/00	711.5	862.8	858.0		0		0		0		0
111/16-21-031-27W3/00	697.5	850.4	846.1	841.1	5		0	835.1	6	834.1	1
141/06-22-031-27W3/00	694.2	853.0	848.8	841.8	7		0	820.1	21.7		0
111/02-23-031-27W3/00	697.7	866.3	862.1	858.1	4		0	854	4.1	852.3	1.7
131/15-23-031-27W3/00	695.9	852.0	847.9		0	844.9	3		0	823.5	21.4
131/09-24-031-27W3/00	699.1	856.6	852.7	849.4	3.3		0	848.3	1.1	846.7	1.6
101/10-26-031-27W3/00	690.4	841.1	839.4	835.3	4.1		0	823.7	11.6	822.6	1.1
141/02-27-031-27W3/00	690.4	838.2	834.0	830.7	3.3		0	820.4	10.3	818.7	1.7
121/07-30-031-27W3/00	726.7	886.1	883.6	878.5	5.1	877.6	0.9	857.9	19.7		0
141/06-31-031-27W3/00	716.2	869.3	865.0	859.1	5.9		0	852.9	6.2	851.2	1.7
121/06-32-031-27W3/00	725.1	855.9	852.4	847.2	5.2		0	839.7	7.5	838	1.7
111/16-32-031-27W3/00	719.4	852.6	848.4	845.2	3.2		0	835.7	9.5	834.6	1.1
111/03-33-031-27W3/00	711.0	861.0	856.7	851.4	5.3		0	837.7	13.7	836.9	0.8
101/14-34-031-27W3/00	704.1	858.6	854.5	852.6	1.9	851.9	0.7	835.3	16.6	834.4	0.9
141/08-36-031-27W3/00	714.9	882.6	878.8		0	878	0.8	862.8	15.2		0
111/03-01-031-28W3/00	699.5	873.4	870.1	863.1	7		0	852.3	10.8	850.4	1.9
141/14-07-031-28W3/00	675.4	850.3	847.5	840.5	7		0	825.7	14.8	824	1.7
121/01-11-031-28W3/00	734.6	902.7	899.9	892.1	7.8		0	883.7	8.4	882.6	1.1
111/10-12-031-28W3/00	723.8	897.0	893.5	884.3	9.2		0	873.8	10.5	872.8	1
141/15-13-031-28W3/00	714.1	882.7	879.4	872.4	7		0	855.4	17		0
111/06-19-031-28W3/00	669.5	850.0	846.9	842.5	4.4	841.6	0.9	836.7	4.9	834.8	1.9
121/15-21-031-28W3/00	694.6	858.8	856.0	851.9	4.1		0	835.1	16.8		0
101/11-22-031-28W3/00	680.2	841.9	838.5	835.3	3.2	834.3	1	813.9	20.4		0
121/12-24-031-28W3/00	694.0	849.2	846.0	840.0	6		0	833.6	6.4	832.7	0.9
101/14-25-031-28W3/00	689.2	839.7	836.4	831.5	4.9	829.9	1.6	821.4	8.5	819.6	1.8
121/16-26-031-28W3/00	668.8	822.9	819.9	813.9	6		0	802	11.9	800.2	1.8
131/02-27-031-28W3/00	666.2	835.8	832.8	825.2	7.6		0	812.8	12.4	811.9	0.9
101/04-27-031-28W3/00	670.1	824.8	821.0	817.1	3.9		0	800	17.1	799.3	0.7
131/08-28-031-28W3/00	684.0	839.5	835.9	832.4	3.5	831.6	0.8	816	15.6	814.6	1.4
101/16-28-031-28W3/00	680.9	835.4	831.3	824.6	6.7		0	811.2	13.4	810.4	0.8
111/01-32-031-28W3/00	722.0	873.0	870.0	864.9	5.1		0	856.5	8.4	853.9	2.6
101/10-32-031-28W3/00	725.7	895.6	892.4	888.5	3.9		0	878.4	10.1	876.7	1.7
101/08-33-031-28W3/00	675.9	834.0	830.0	826.1	3.9		0	813.1	13	811.4	1.7
121/15-34-031-28W3/00	669.0	806.8	803.8	799.1	4.7		0	784.1	15	782.3	1.8
101/01-35-031-28W3/00	682.4	837.6	834.5	829.4	5.1		0	819.2	10.2	817.8	1.4
111/15-35-031-28W3/00	692.2	841.2	837.8	834.1	3.7		0	813.4	20.7		0
111/03-36-031-28W3/00	685.2	832.4	829.4	824.7	4.7	824.1	0.6	812.9	11.2	811.2	1.7
111/16-36-031-28W3/00	701.3	853.0	849.5	845.2	4.3		0	834.8	10.4	833.6	1.2
121/09-02-031-29W3/00	707.0	901.5	899.7	892.0	7.7		0	877.2	14.8	875.8	1.4
111/11-12-031-29W3/00	699.1	881.9	879.0	872.1	6.9		0	856.3	15.8	854.5	1.8
121/11-36-031-29W3/00	715.4	886.1	883.7	879.4	4.3		0	857.2	22.2		0
131/16-08-032-21W3/00	700.2	815.8	807.7		0	806.6	1.1	783.4	23.2	783	0.4
101/01-07-032-22W3/00	687.0	806.3	800.7		0	799.6	1.1	783.9	15.7	778.8	5.1
131/11-25-032-22W3/00	699.0	803.8	797.8		0	797.1	0.7	778.3	18.8		0
111/07-10-032-23W3/00	715.7	828.0	821.8	818.7	3.1	818	0.7		0	817	1
131/11-13-032-23W3/00	690.3	813.5	807.6	805.3	2.3		0	802.7	2.6	800.7	2
111/14-03-032-24W3/00	712.4	835.3	830.3		0		0	813.9	16.4		0
131/12-04-032-24W3/00	691.3	804.7	800.0		0	798.8	1.2	786.6	12.2		0
101/10-06-032-24W3/00	691.7	806.8	801.5		0	800.8	0.7	795.8	5	794.2	1.6
131/07-07-032-24W3/00	704.3	814.5	809.4		0		0	797.7	11.7	796.8	0.9
111/15-09-032-24W3/00	699.6	810.2	805.6		0		0	796.4	9.2	794.8	1.6
141/05-15-032-24W3/00	703.4	818.3	814.0		0		0	806	8	804.5	1.5
111/07-17-032-24W3/00	677.1	781.0	776.8		0	776.1	0.7	763.1	13	762.3	0.8
131/06-19-032-24W3/00	712.2	830.3	825.5		0		0	813.9	11.6	813.1	0.8
131/14-19-032-24W3/00	712.7	818.3	813.3		0	812.6	0.7	803	9.6	802	1
111/15-19-032-24W3/00	708.0	818.2	813.6	811.3	2.3		0	803	8.3	802	1
111/13-20-032-24W3/00	712.1	816.2	811.4		0	810.7	0.7	803.7	7	802.6	1.1
121/09-22-032-24W3/00	705.9	825.1	820.1	814.0	6.1		0	803.6	10.4		0
121/10-22-032-24W3/00	699.5	820.7	815.2		0	814.4	0.8	808	6.4		0
141/14-23-032-24W3/00	710.4	830.2	825.1		0		0	822	3.1		0
111/04-27-032-24W3/00	692.1	815.7	811.8		0	808.3	3.5		0		0
121/01-29-032-24W3/00	716.5	818.8	814.1		0	813.4	0.7	810.8	2.6	808.5	2.3
131/04-29-032-24W3/00	720.6	826.6	821.2	818.8	2.4		0	811.8	7	810.9	0.9
131/02-30-032-24W3/00	722.0	827.5	822.3		0	821.8	0.5	813.9	7.9	812.6	1.3
141/05-30-032-24W3/00	723.5	820.4	815.8	813.0	2.8		0	805.9	7.1	804.9	1
111/07-31-032-24W3/00	719.8	819.3	814.8		0	813.5	1.3	807.9	5.6	806.6	1.3
111/09-31-032-24W3/00	718.7	821.5	816.9		0	816.3	0.6	810.1	6.2	808.6	1.5
131/11-32-032-24W3/00	717.2	816.4	812.1		0		0	806.3	5.8	804.6	1.7
131/05-33-032-24W3/00	720.4	822.6	818.1		0		0	810.7	7.4		0
111/06-04-032-25W3/00	702.1	829.5	824.4		0		0		0	822.1	2.3
111/11-12-032-25W3/02	707.9	819.7	815.0		0	813.9	1.1	810	3.9	808.6	1.4
131/11-13-032-25W3/00	709.5	815.3	811.0		0	809.2	1.8	800.4	8.8	799	1.4
111/10-14-032-25W3/00	699.4	820.2	815.0		0	814.3	0.7	801.2	13.1	800.5	0.7
111/10-15-032-25W3/00	696.7	811.8	807.8		0	807.2	0.6	792.2	15		0
111/12-20-032-25W3/00	703.3	810.1	805.8		0		0	792.2	13.6		0

Well I.D.	KB (m)	B. Valley TVD (m)	F1 Lower TVD (m)	F2/F3 Low. TVD (m)	F2/F3 Low. ISO (m)	F4 TVD (m)	F4 ISO (m)	FA2 TVD (m)	FA2 ISO (m)	F2 Up. TVD (m)	F2 Up. ISO (m)
141/01-21-032-25W3/00	697.6	800.1	795.6		0		0	792.6	3	790.8	1.8
131/15-22-032-25W3/00	707.4	811.4	807.4		0		0	796.8	10.6	795.5	1.3
131/03-24-032-25W3/00	711.0	818.2	813.4		0		0	797.9	15.5		0
111/14-24-032-25W3/00	713.8	827.3	822.0		0	820.9	1.1	814.2	6.7	812.4	1.8
111/07-26-032-25W3/00	714.3	819.6	814.7		0	814.1	0.6	809	5.1	807.2	1.8
101/14-27-032-25W3/00	711.8	824.0	819.5		0		0	803	16.5	802.1	0.9
111/10-33-032-25W3/00	706.4	816.3	812.1		0	809.8	2.3	801.8	8	800.4	1.4
141/04-35-032-25W3/00	710.7	820.2	815.1		0		0		0		0
131/10-36-032-25W3/00	733.8	842.0	837.4		0		0	824.2	13.2	823.3	0.9
141/12-05-032-26W3/02	724.0	910.6	905.9		0	905	0.9	898.8	6.2	897.7	1.1
111/14-03-032-27W3/00	708.2	868.7	863.5		0	862	1.5	849.8	12.2		0
101/08-04-032-27W3/00	709.0	851.9	848.3		0		0		0		0
101/02-05-032-27W3/00	727.3	865.3	861.7	857.5	4.2		0	853.2	4.3	851.5	1.7
101/10-05-032-27W3/00	731.5	878.1	875.1	874.1	1	873.5	0.6	864.1	9.4	862.4	1.7
111/04-06-032-27W3/00	708.1	849.9	845.7	841.9	3.8	841.4	0.5	831.8	9.6	830.5	1.3
141/11-06-032-27W3/00	706.2	853.0	848.6		0	844.2	4.4	830.1	14.1		0
121/07-07-032-27W3/00	705.8	845.1	840.7	837.9	2.8	836.7	1.2	818.9	17.8		0
101/09-08-032-27W3/00	726.5	881.0	878.0		0	877	1	862.3	14.7	860.8	1.5
141/04-09-032-27W3/00	737.2	879.0	874.8		0		0	861.9	12.9	860.7	1.2
131/13-10-032-27W3/00	727.0	876.8	872.7		0	871.8	0.9	861.9	9.9	860.3	1.6
141/12-12-032-27W3/00	710.9	869.7	865.2	863.5	1.7		0	852.6	10.9		0
121/01-19-032-27W3/00	713.9	884.0	880.7	879.9	0.8		0	879	0.9	877.5	1.5
111/08-36-032-27W3/02	726.1	891.5	888.5	884.0	4.5		0	875.8	8.2		0
111/04-01-032-28W3/00	724.1	832.7	830.0	822.6	7.4		0	805.5	17.1		0
130/15-02-032-28W3/00	680.6	817.9	814.5	809.7	4.8		0	797.5	12.2	796	1.5
101/08-03-032-28W3/00	666.0	798.0	794.4	790.8	3.6		0	778.7	12.1	776.5	2.2
101/10-03-032-28W3/00	683.1	810.5	807.3	803.5	3.8		0	799.3	4.2	796.4	2.9
111/14-04-032-28W3/00	733.3	874.0	870.5	867.1	3.4		0	850.1	17		0
101/12-06-032-28W3/00	722.3	857.5	854.6	851.3	3.3		0		0		0
121/12-07-032-28W3/00	736.6	890.3	887.3	883.3	4		0	868.8	14.5	867.9	0.9
141/09-08-032-28W3/00	741.0	894.9	892.1	890.0	2.1		0	867	23		0
141/07-09-032-28W3/00	727.1	874.7	870.6	867.6	3		0	852.3	15.3		0
131/16-10-032-28W3/00	704.8	853.1	848.8	847.1	1.7		0	827.3	19.8		0
121/03-12-032-28W3/00	703.0	839.9	835.9	832.2	3.7		0	813.5	18.7		0
111/07-12-032-28W3/00	691.9	854.7	850.9	846.4	4.5		0	823	23.4	821.7	1.3
101/03-16-032-28W3/00	744.3	898.0	894.3	891.0	3.3		0	869.4	21.6		0
121/13-20-032-28W3/00	715.5	852.3	849.0	842.6	6.4		0		0	831.7	10.9
131/11-21-032-28W3/00	717.6	859.3	856.0	851.4	4.6		0	849.8	1.6	847.4	2.4
131/11-22-032-28W3/00	729.7	892.0	888.4	884.0	4.4	883.1	0.9	866.9	16.2		0
141/10-24-032-28W3/00	701.8	852.4	848.0	843.2	4.8		0	830.6	12.6		0
131/04-28-032-28W3/00	735.7	878.0	874.0	870.1	3.9	868.8	1.3	859	9.8	858	1
131/09-28-032-28W3/00	734.1	884.9	881.9	877.9	4	877.3	0.6	864.2	13.1		0
111/13-28-032-28W3/00	726.1	885.9	883.4	878.5	4.9		0	865.9	12.6		0
111/15-28-032-28W3/00	734.6	877.6	874.6	869.9	4.7		0	855.6	14.3		0
101/07-29-032-28W3/00	726.1	866.2	862.5	857.9	4.6		0	847.7	10.2		0
111/11-35-032-28W3/00	716.6	866.9	863.5	860.1	3.4		0	849.6	10.5		0
101/10-01-032-29W3/00	723.5	857.0	853.7	851.5	2.2	850.9	0.6	829.2	21.7		0
141/06-25-032-29W3/00	713.6	855.2	852.0	847.7	4.3		0	841	6.7		0
141/06-19-033-24W3/02	700.9	788.0	785.1		0		0	771.5	13.6	770.5	1
121/01-01-033-25W3/00	717.0	826.9	822.8		0	822.3	0.5	811.2	11.1	810.6	0.6
121/11-01-033-25W3/00	719.3	826.2	822.7		0	819.6	3.1	808.3	11.3	807.3	1
101/03-03-033-25W3/02	709.2	812.0	808.2	806.7	1.5		0	795.1	11.6		0
141/09-09-033-25W3/00	724.1	822.8	821.9		0		0		0		0
101/04-13-033-25W3/00	718.1	804.7	802.3		0	801.9	0.4	785.4	16.5		0
101/06-22-033-25W3/00	725.2	810.8	806.8		0		0	795.5	11.3	794.1	1.4
141/02-27-033-25W3/00	719.7	805.0	801.0	799.9	1.1		0	789	10.9	786.9	2.1
121/11-30-033-25W3/00	720.5	848.4	846.7		0		0		0		0
111/10-32-033-25W3/00	727.1	835.8	833.7		0		0		0		0
141/10-05-033-26W3/00	721.1	855.8	852.3		0		0	847.1	5.2	845.8	1.3
131/02-10-033-26W3/00	723.9	851.5	849.5		0		0	834.5	15		0
121/11-17-033-26W3/00	734.3	876.6	873.9		0		0	861.8	12.1	861	0.8
121/07-19-033-26W3/00	741.0	855.8	854.5		0		0		0		0
111/10-21-033-26W3/00	721.0	845.1	843.0	840.6	2.4		0	834.3	6.3	833.4	0.9
111/12-25-033-26W3/00	727.2	848.0	845.0		0		0	834.7	10.3		0
121/06-26-033-26W3/00	724.5	856.3	854.8	852.2	2.6		0	847.6	4.6	846.1	1.5
111/09-26-033-26W3/00	727.0	849.0	845.8		0		0		0		0
111/06-13-033-27W3/02	741.7	890.1	887.9	887.0	0.9		0	882.3	4.7	880.7	1.6
111/07-18-033-27W3/00	712.9	866.9	864.2		0		0	848.8	15.4		0
121/02-19-033-27W3/00	710.5	855.7	853.0		0		0		0		0
131/16-30-033-27W3/00	737.6	873.4	869.7	865.8	3.9		0	863.9	1.9	862.9	1
101/06-31-033-27W3/00	740.7	875.7	872.6	871.8	0.8		0	861.1	10.7	860.2	0.9
131/05-32-033-27W3/00	727.0	847.6	845.0	844.4	0.6		0		0	834.1	10.3
141/15-32-033-27W3/00	724.5	847.3	844.6	843.3	1.3		0	840.1	3.2	838.4	1.7
111/07-34-033-27W3/00	720.2	837.0	833.7	833.0	0.7		0	830.8	2.2	829.7	1.1
111/05-03-033-28W3/00	730.3	868.9	865.2	864.2	1		0	855.2	9		0
111/15-03-033-28W3/00	731.1	884.9	880.4	877.8	2.6		0	869.3	8.5		0
111/16-04-033-28W3/00	724.3	862.0	858.6	856.5	2.1		0	854.6	1.9		0
121/08-10-033-28W3/00	729.7	881.7	878.0	876.6	1.4		0	872.6	4		0

Well I.D.	KB (m)	B. Valley TVD (m)	F1 Lower TVD (m)	F2/F3 Low. TVD (m)	F2/F3 Low. ISO (m)	F4 TVD (m)	F4 ISO (m)	FA2 TVD (m)	FA2 ISO (m)	F2 Up. TVD (m)	F2 Up. ISO (m)
111/04-20-033-28W3/00	718.5	875.8	874.9		0		0	868.6	6.3		0
111/08-20-033-28W3/00	724.3	880.6	877.8	876.7	1.1		0	866.4	10.3	865.4	1
111/10-21-033-28W3/00	723.6	878.5	875.7	871.1	4.6		0	861.4	9.7	859.9	1.5
111/16-21-033-28W3/00	727.4	872.4	869.9	868.9	1		0	856.5	12.4		0
101/10-22-033-28W3/00	729.7	879.9	876.9	876.0	0.9		0	865.8	10.2		0
101/06-25-033-28W3/00	734.0	871.1	867.5		0		0	860.1	7.4	859.4	0.7
131/07-25-033-28W3/00	731.3	867.0	862.9		0		0	857.7	5.2	856.8	0.9
101/14-25-033-28W3/00	727.3	864.9	861.1		0		0	851.1	10	850.2	0.9
101/07-26-033-28W3/00	738.5	877.8	873.0	871.2	1.8		0	861	10.2		0
111/03-27-033-28W3/00	738.4	889.9	887.4	887.2	0.2		0	880.4	6.8		0
111/01-28-033-28W3/00	727.1	868.0	864.4	863.9	0.5	863.6	0.3	857.2	6.4		0
111/14-33-033-28W3/00	747.6	885.0	883.0	879.1	3.9		0	874.2	4.9	873.2	1
101/04-36-033-28W3/00	729.1	865.9	863.3		0		0	857.2	6.1	856.3	0.9
111/06-36-033-28W3/00	727.3	858.5	855.6		0		0	850.6	5	848.8	1.8
141/08-02-033-29W3/00	707.5	835.6	832.0	828.2	3.8		0	823.9	4.3	823.1	0.8
141/09-11-033-29W3/00	716.6	845.0	841.6	838.4	3.2		0	831.7	6.7	829.9	1.8
111/07-16-034-24W3/00	692.7	805.8	803.5		0		0		0		0
131/01-04-034-25W3/00	724.6	845.1	842.8	838.3	4.5		0	826.1	12.2	825.4	0.7
131/06-16-034-25W3/00	735.8	828.0	825.8	818.2	7.6		0	809.1	9.1		0
141/10-30-034-25W3/00	734.0	829.0	826.6	823.5	3.1		0	805.1	18.4	804.2	0.9
111/05-04-034-26W3/00	735.6	847.5	845.0	843.6	1.4		0	828.7	14.9		0
141/07-07-034-26W3/00	722.5	852.7	850.2		0		0	832.5	17.7		0
131/11-10-034-26W3/00	729.1	834.4	833.0	830.7	2.3		0	810.1	20.6		0
101/14-13-034-26W3/00	732.0	820.8	818.5	815.3	3.2		0	793.3	22		0
131/09-14-034-26W3/00	736.3	828.0	825.1	823.3	1.8		0	801.5	21.8		0
141/13-15-034-26W3/00	730.0	818.3	816.1	814.2	1.9		0	809.3	4.9		0
121/06-16-034-26W3/00	746.7	849.0	846.5	845.0	1.5		0	829.6	15.4		0
141/05-19-034-26W3/00	732.9	851.2	849.5	848.7	0.8		0	841.1	7.6		0
111/08-23-034-26W3/00	735.1	821.9	819.6		0		0	794.8	24.8		0
131/07-24-034-26W3/00	734.8	820.0	817.5	814.8	2.7		0	793.9	20.9		0
121/06-26-034-26W3/00	747.7	842.1	838.9	836.2	2.7		0	833.4	2.8	831.9	1.5
121/14-29-034-26W3/00	742.6	843.8	841.7		0		0	824.7	17		0
141/04-30-034-26W3/00	732.2	838.9	837.1		0		0	814.9	22.2		0
111/13-30-034-26W3/00	731.1	835.5	833.1	824.7	8.4		0	814.1	10.6		0
111/01-31-034-26W3/00	735.7	841.4	839.8		0		0		0		0
111/04-31-034-26W3/00	731.5	839.1	837.0	832.1	4.9		0	821.6	10.5		0
131/14-31-034-26W3/00	729.4	833.8	832.3		0		0		0		0
111/11-32-034-26W3/00	738.9	841.2	838.9		0		0	821.4	17.5		0
101/16-32-034-26W3/00	748.1	840.1	838.1	836.1	2		0	817.4	18.7		0
131/02-33-034-26W3/00	748.1	850.3	848.7	841.2	7.5		0	825.6	15.6		0
111/11-33-034-26W3/00	745.6	849.1	846.0	840.0	6		0	820.8	19.2		0
141/04-34-034-26W3/00	733.7	828.9	826.9	820.1	6.8		0	812.7	7.4	812.1	0.6
111/11-34-034-26W3/00	737.0	840.4	838.8	828.4	10.4		0	815.4	13		0
141/16-34-034-26W3/00	746.0	842.4	839.9	833.6	6.3		0	818	15.6		0
141/14-35-034-26W3/00	749.6	844.0	840.5	838.6	1.9		0	820.2	18.4		0
121/09-01-034-27W3/00	719.3	847.9	846.0		0	845.2	0.8		0	834.8	10.4
121/08-13-034-27W3/00	720.1	834.2	831.6	830.8	0.8		0	829.8	1	828.7	1.1
111/16-15-034-27W3/00	715.8	827.8	825.8		0		0	806.1	19.7		0
111/13-16-034-27W3/00	712.7	825.7	823.4	818.3	5.1		0	808.8	9.5	807.4	1.4
101/16-20-034-27W3/00	712.6	817.0	815.3	814.0	1.3		0	804.4	9.6		0
111/06-21-034-27W3/00	708.8	832.2	830.8		0		0	809.8	21		0
121/01-25-034-27W3/00	728.0	834.0	831.7		0		0	810.7	21	808.8	1.9
111/09-25-034-27W3/00	730.0	835.0	833.4	825.9	7.5		0	815.1	10.8		0
111/15-25-034-27W3/00	725.8	833.2	831.4		0		0	816.1	15.3		0
111/13-27-034-27W3/00	717.9	830.0	826.9	818.5	8.4		0	806.3	12.2		0
111/06-28-034-27W3/00	705.5	819.5	817.0	813.3	3.7		0	801.9	11.4		0
111/06-28-034-27W3/02	705.5	819.5	817.0	813.3	3.7		0	801.9	11.4		0
131/08-34-034-27W3/00	718.7	828.3	826.0		0		0	814.8	11.2	813.9	0.9
111/09-35-034-27W3/00	728.8	842.0	839.0		0		0	819.5	19.5		0
111/03-36-034-27W3/00	723.5	829.7	827.5		0		0	809.3	18.2		0
111/10-36-034-27W3/00	732.0	839.3	837.0		0		0	815	22		0
121/07-03-034-28W3/00	755.5	880.5	878.2	876.6	1.6		0	875.2	1.4		0
111/12-03-034-28W3/00	752.6	887.7	885.9	880.0	5.9		0	867.6	12.4	866	1.6
111/10-04-034-28W3/00	753.5	897.0	892.4		0		0	878.4	14	876.7	1.7
141/16-05-034-28W3/00	761.1	911.1	910.1		0		0	884.6	25.5		0
111/06-07-034-28W3/00	736.7	875.7	874.0		0		0	861.6	12.4		0
111/08-08-034-28W3/02	772.3	913.6	909.5		0		0	901.4	8.1	900.4	1
111/06-09-034-28W3/00	761.4	894.6	890.9		0		0	877.8	13.1		0
111/10-14-034-28W3/00	756.1	891.9	891.0	887.4	3.6		0	877.8	9.6		0
141/14-22-034-28W3/00	783.6	914.0	911.4	906.2	5.2		0	895.1	11.1		0
141/06-27-034-28W3/00	778.1	900.1	897.5		0		0		0		0
141/05-31-034-28W3/00	725.1	870.0	866.8	863.7	3.1		0	857.9	5.8	857.3	0.6
121/11-12-034-29W3/00	726.5	859.8	857.7		0		0	850.8	6.9		0
111/15-25-034-29W3/00	723.7	858.4	856.4	854.1	2.3		0	848.4	5.7		0
111/07-36-034-29W3/00	719.6	855.0	853.8		0	853	0.8	839.7	13.3		0
111/07-36-034-29W3/02	719.6	855.0	853.8		0	853	0.8	839.7	13.3		0
111/10-36-034-29W3/00	728.0	858.3	857.4	856.3	1.1		0	847.4	8.9		0
121/15-36-034-29W3/00	716.8	847.3	846.1	842.0	4.1		0		0		0

Well I.D.	KB (m)	B. Valley TVD (m)	F1 Lower TVD (m)	F2/F3 Low. TVD (m)	F2/F3 Low. ISO (m)	F4 TVD (m)	F4 ISO (m)	FA2 TVD (m)	FA2 ISO (m)	F2 Up. TVD (m)	F2 Up. ISO (m)
141/06-09-035-24W3/00	679.1	770.1	769.0		0		0		0		0
121/01-19-035-24W3/02	695.8	787.3	784.3		0		0		0		0
111/03-05-035-25W3/02	729.9	814.9	812.2		0		0		0	810.1	2.1
121/13-06-035-25W3/00	735.2	817.0	814.8	812.2	2.6		0	799.4	12.8		0
111/03-07-035-25W3/02	732.4	810.8	808.9	807.7	1.2		0	790.2	17.5		0
111/16-07-035-25W3/00	707.6	784.1	781.5		0		0	762.7	18.8	762.3	0.4
131/09-09-035-25W3/00	715.4	796.7	794.7		0		0	775	19.7	772.9	2.1
121/11-12-035-25W3/00	701.8	805.1	800.8		0		0	784.6	16.2		0
141/05-13-035-25W3/00	684.7	785.0	782.0		0		0		0		0
111/16-19-035-25W3/00	716.7	772.0	770.0	766.9	3.1		0	749.4	17.5		0
141/09-20-035-25W3/00	706.9	772.7	770.5		0		0	744.7	25.8		0
141/08-21-035-25W3/00	702.9	762.0	760.8		0		0	739.7	21.1		0
141/03-27-035-25W3/00	694.5	766.4	764.4		0		0	746.7	17.7		0
131/03-28-035-25W3/00	698.8	760.9	758.0		0		0	738.5	19.5		0
111/05-28-035-25W3/00	700.2	760.2	757.6		0		0		0		0
141/08-28-035-25W3/00	696.7	756.4	754.5		0		0	726.1	28.4		0
111/07-29-035-25W3/00	704.5	760.4	757.7		0		0	735.9	21.8		0
121/12-31-035-25W3/00	713.2	761.3	759.0		0		0	744.5	14.5		0
111/13-32-035-25W3/00	696.6	749.5	745.9	744.8	1.1		0	725.9	18.9		0
111/03-33-035-25W3/00	695.3	754.4	751.9		0		0	728.7	23.2		0
121/10-33-035-25W3/00	695.7	748.0	745.0		0		0	729.1	15.9		0
111/04-01-035-26W3/00	747.2	841.0	838.0		0		0	817.8	20.2		0
111/11-01-035-26W3/00	744.5	836.5	833.9		0		0	814.6	19.3		0
111/05-02-035-26W3/00	746.6	842.0	839.0		0		0	820.6	18.4		0
111/15-02-035-26W3/00	741.8	832.8	829.7		0		0	815	14.7		0
111/01-03-035-26W3/00	742.6	843.3	842.4		0		0	822.3	20.1		0
111/05-03-035-26W3/00	746.4	842.3	840.2		0		0	823.6	16.6		0
111/15-03-035-26W3/00	760.1	860.2	857.4		0		0	837.8	19.6		0
111/02-04-035-26W3/00	738.7	845.0	843.8		0		0	821.3	22.5		0
131/13-04-035-26W3/00	725.4	829.9	827.0		0		0	806.9	20.1		0
141/14-04-035-26W3/00	728.2	831.0	828.0		0		0	810.4	17.6		0
141/16-04-035-26W3/00	745.0	837.8	836.6		0		0	830.6	6		0
121/10-05-035-26W3/00	728.9	830.9	829.5		0		0	808.7	20.8		0
111/04-06-035-26W3/00	738.3	841.9	839.6	834.1	5.5		0	824.1	10		0
111/16-06-035-26W3/00	739.7	840.3	837.6	833.0	4.6		0	827.3	5.7		0
111/01-07-035-26W3/00	742.5	850.4	847.7	845.7	2		0	838.3	7.4	837.7	0.6
111/09-08-035-26W3/00	728.5	814.1	811.0		0		0	798.3	12.7		0
121/15-09-035-26W3/00	738.0	826.4	824.1	822.5	1.6		0	808.9	13.6		0
121/11-10-035-26W3/00	760.1	850.7	848.8		0		0		0		0
101/16-10-035-26W3/00	752.0	842.0	840.5		0		0	822.8	17.7		0
101/09-11-035-26W3/00	750.0	831.7	829.2		0		0	822.3	6.9		0
111/08-12-035-26W3/00	747.3	823.4	821.7		0		0	812.9	8.8		0
121/06-18-035-26W3/02	739.9	840.0	837.3		0		0	824.9	12.4		0
111/13-20-035-26W3/00	730.5	820.4	818.0	815.5	2.5		0	793.8	21.7		0
111/14-21-035-26W3/00	703.1	780.8	778.5	773.8	4.7		0	758.4	15.4		0
101/06-22-035-26W3/00	715.4	800.7	799.1	798.4	0.7		0	796.3	2.1	795.5	0.8
111/01-32-035-26W3/00	687.2	771.9	769.3	766.7	2.6		0	752.3	14.4		0
141/09-34-035-26W3/00	753.2	818.3	815.7		0		0	795.5	20.2		0
141/09-36-035-26W3/00	712.8	769.2	766.5		0		0	745.4	21.1		0
111/02-01-035-27W3/00	741.9	843.5	841.6		0		0	829.6	12		0
121/09-01-035-27W3/00	738.2	840.9	839.0		0		0	832.5	6.5	831.7	0.8
111/16-05-035-27W3/00	736.0	844.2	841.6		0		0	815.6	26		0
141/03-06-035-27W3/00	774.2	876.0	873.7		0		0	856.1	17.6		0
111/09-07-035-27W3/00	759.8	867.9	865.7		0		0	861.2	4.5		0
111/08-08-035-27W3/02	741.8	851.0	847.9		0		0	824.8	23.1		0
121/05-10-035-27W3/00	715.6	820.8	818.2		0		0	796	22.2		0
111/10-11-035-27W3/00	730.2	822.0	820.0		0		0	801.2	18.8		0
111/10-12-035-27W3/00	730.4	821.6	818.8	818.0	0.8		0	799.1	18.9		0
111/04-13-035-27W3/00	731.2	835.0	832.7	831.8	0.9		0	813.1	18.7		0
121/14-14-035-27W3/00	724.6	821.0	819.3		0		0		0		0
131/04-15-035-27W3/00	732.5	837.8	836.5		0		0	818.1	18.4		0
141/08-15-035-27W3/00	716.4	809.8	807.0	806.1	0.9		0	787.4	18.7		0
111/04-17-035-27W3/00	750.9	874.7	868.3	867.1	1.2		0		0		0
111/08-17-035-27W3/00	763.0	857.8	855.0	853.6	1.4		0		0	852.1	1.5
121/10-19-035-27W3/00	776.2	877.6	875.1	873.6	1.5		0		0		0
141/10-21-035-27W3/00	748.4	846.1	841.3		0		0		0		0
111/01-22-035-27W3/00	720.8	816.0	814.0		0		0	794.1	19.9		0
111/11-23-035-27W3/00	720.2	808.9	806.2		0		0	797.9	8.3		0
131/09-24-035-27W3/00	734.3	819.0	815.8	814.8	1		0	798.4	16.4		0
111/06-29-035-27W3/00	749.8	843.0	841.0	838.3	2.7		0		0		0
101/11-31-035-27W3/00	767.4	872.1	868.9		0		0	850.2	18.7		0
131/06-32-035-27W3/02	775.3	874.1	871.5		0		0	864.9	6.6		0
101/12-34-035-27W3/00	746.4	831.5	830.0	828.6	1.4		0		0		0
111/10-06-035-28W3/00	693.7	825.7	823.7		0		0	820.6	3.1		0
111/13-12-035-28W3/00	772.6	884.2	881.6	879.1	2.5		0		0		0
111/07-13-035-28W3/00	776.8	887.2	885.2	883.3	1.9		0		0		0
101/14-17-035-28W3/00	714.0	839.5	836.8	832.5	4.3		0	824.1	8.4		0
101/09-18-035-28W3/00	699.0	821.7	818.5	815.5	3		0	812.3	3.2		0

Well I.D.	KB (m)	B. Valley TVD (m)	F1 Lower TVD (m)	F2/F3 Low. TVD (m)	F2/F3 Low. ISO (m)	F4 TVD (m)	F4 ISO (m)	FA2 TVD (m)	FA2 ISO (m)	F2 Up. TVD (m)	F2 Up. ISO (m)
111/08-19-035-28W3/00	719.2	844.8	840.1	839.1	1		0		0		0
141/10-21-035-28W3/00	801.8	922.9	921.4		0		0	915.8	5.6		0
142/12-21-035-28W3/00	791.5	925.5	922.3	920.4	1.9		0		0		0
141/16-21-035-28W3/00	795.0	911.0	908.0	906.7	1.3		0	904.3	2.4		0
111/12-22-035-28W3/00	797.1	919.2	916.1	915.1	1		0	906.5	8.6		0
101/13-24-035-28W3/00	762.0	868.0	865.7	863.9	1.8		0		0		0
111/16-26-035-28W3/00	758.2	868.7	865.0		0		0	848	17		0
191/06-27-035-28W3/00	783.6	888.9	886.1		0		0		0		0
111/07-28-035-28W3/00	798.9	914.5	909.8	904.1	5.7		0	889.7	14.4		0
111/13-28-035-28W3/00	794.9	914.1	909.6	906.5	3.1		0	891	15.5		0
121/09-29-035-28W3/00	795.0	910.2	906.4	903.8	2.6		0	890.4	13.4		0
111/11-32-035-28W3/00	771.9	890.0	886.3		0		0		0		0
121/03-33-035-28W3/00	789.3	895.1	891.2		0		0	880.7	10.5		0
131/04-34-035-28W3/00	746.5	854.8	851.7		0		0	836.9	14.8		0
121/06-34-035-28W3/00	730.4	846.8	843.0		0		0	826.2	16.8		0
111/11-34-035-28W3/00	729.1	835.0	831.5		0		0	819.3	12.2		0
141/01-35-035-28W3/00	738.9	847.8	844.2		0		0	827.4	16.8		0
111/06-35-035-28W3/00	720.1	828.0	824.7		0		0		0		0
141/02-04-036-25W3/00	694.8	746.0	744.5		0		0	731.7	12.8	729.5	2.2
111/13-04-036-25W3/00	700.0	756.0	754.3		0		0	739	15.3		0
121/06-05-036-25W3/00	691.4	740.2	738.1		0		0	714.2	23.9		0
111/14-05-036-25W3/00	695.1	750.6	748.1		0		0	725.2	22.9		0
111/04-06-036-25W3/00	704.3	757.5	756.0		0		0	732.5	23.5		0
111/03-07-036-25W3/00	690.7	730.0	727.3		0		0	711.1	16.2		0
141/13-07-036-25W3/00	689.7	733.2	729.5		0		0	712.4	17.1		0
111/16-07-036-25W3/00	695.5	748.5	745.4		0		0	726.2	19.2		0
111/03-08-036-25W3/00	696.8	751.0	749.0		0		0	728.4	20.6		0
111/16-08-036-25W3/00	705.1	758.8	754.6		0		0	737.9	16.7		0
111/04-09-036-25W3/00	701.4	755.4	753.5		0		0	731.5	22		0
101/10-09-036-25W3/00	709.4	776.0	774.5		0		0		0		0
101/07-17-036-25W3/00	693.4	744.9	741.0		0		0	727	14		0
101/13-17-036-25W3/00	684.9	735.8	732.4		0		0	717	15.4		0
101/03-18-036-25W3/00	691.6	754.1	750.1		0		0	734.6	15.5		0
111/14-18-036-25W3/00	684.7	733.0	733.1		0		0	719.7	13.4		0
111/11-31-036-25W3/02	683.8	740.8	739.0		0		0	737.9	1.1		0
111/10-32-036-25W3/00	698.9	765.1	762.2		0		0	761.1	1.1		0
111/06-06-036-26W3/00	695.2	755.0	752.0		0		0		0		0
121/07-12-036-26W3/00	696.6	742.7	739.8	737.2	2.6		0	724.9	12.3		0
131/16-12-036-26W3/00	688.4	729.8	725.9		0		0	710.6	15.3		0
101/01-13-036-26W3/00	688.0	737.7	734.1		0		0	721.8	12.3		0
111/08-13-036-26W3/00	687.9	746.2	743.1		0		0	728	15.1		0
111/15-13-036-26W3/00	688.7	731.6	726.6		0		0		0		0
141/01-19-036-26W3/02	695.7	763.0	760.0	758.7	1.3		0	755.6	3.1		0
111/05-19-036-26W3/00	695.3	773.8	770.5		0		0	763.6	6.9		0
131/09-19-036-26W3/00	692.3	769.8	766.8		0		0	755.5	11.3		0
131/10-20-036-26W3/00	695.2	764.8	760.9		0		0	750	10.9		0
121/12-21-036-26W3/00	693.7	769.5	765.2		0		0	749.9	15.3		0
121/02-24-036-26W3/00	689.3	733.3	728.3	726.7	1.6		0	723.9	2.8		0
121/03-27-036-26W3/00	696.4	764.2	754.0		0		0	747.3	6.7		0
141/15-27-036-26W3/00	693.2	764.5	759.0		0		0	744.2	14.8		0
131/02-28-036-26W3/00	702.4	775.2	771.0		0		0	755.9	15.1		0
121/10-28-036-26W3/00	698.2	768.2	761.7		0		0		0		0
101/03-30-036-26W3/00	688.5	765.4	759.9		0		0	749.7	10.2		0
101/12-32-036-26W3/00	702.9	779.9	777.0		0		0		0		0
111/04-34-036-26W3/00	697.6	759.1	755.7		0		0	752.5	3.2		0
111/06-05-036-27W3/00	759.3	849.9	846.9		0		0	838.5	8.4		0
111/02-06-036-27W3/00	756.8	862.5	859.7		0		0	840.5	19.2		0
111/07-06-036-27W3/00	754.0	868.8	866.7	864.5	2.2		0	842.5	22		0
111/09-06-036-27W3/00	763.7	860.4	858.0		0		0	843.6	14.4		0
131/12-06-036-27W3/00	745.6	846.0	842.0	839.7	2.3		0	829.8	9.9		0
111/06-07-036-27W3/00	743.9	843.0	839.0		0		0	829.4	9.6		0
101/12-08-036-27W3/00	694.8	788.1	782.9		0		0	775.6	7.3		0
141/16-08-036-27W3/00	698.3	791.0	788.1	786.6	1.5		0	763.9	22.7		0
131/12-09-036-27W3/00	699.6	788.6	785.4		0		0	766.6	18.8		0
111/15-09-036-27W3/00	695.9	788.6	784.0		0		0	761.8	22.2		0
131/06-10-036-27W3/00	700.3	781.3	777.2		0		0	759.9	17.3		0
141/12-11-036-27W3/00	689.0	773.7	770.8		0		0	757.3	13.5		0
111/12-13-036-27W3/00	683.3	763.5	758.5		0		0	752.4	6.1		0
131/03-15-036-27W3/00	672.2	765.0	760.4	754.5	5.9		0	737.4	17.1		0
101/09-15-036-27W3/00	675.7	762.3	758.1		0		0	738.2	19.9		0
141/07-22-036-27W3/00	668.9	749.8	745.8		0		0	736.2	9.6		0
111/11-23-036-27W3/00	688.2	769.6	765.3		0		0	754.8	10.5		0
101/03-24-036-27W3/00	684.6	761.3	755.8		0		0		0		0
121/06-30-036-27W3/00	694.7	786.9	781.5		0		0	774	7.5		0
111/13-31-036-27W3/02	685.4	763.1	762.1		0		0	757.3	4.8		0
101/02-01-036-28W3/00	737.3	838.2	835.1		0		0	823.8	11.3		0
101/05-01-036-28W3/00	721.2	833.0	829.1		0		0	811.1	18		0
101/07-01-036-28W3/00	733.7	835.2	831.3		0		0	819.4	11.9		0

Well I.D.	KB (m)	B. Valley TVD (m)	F1 Lower TVD (m)	F2/F3 Low. TVD (m)	F2/F3 Low. ISO (m)	F4 TVD (m)	F4 ISO (m)	FA2 TVD (m)	FA2 ISO (m)	F2 Up. TVD (m)	F2 Up. ISO (m)
131/16-01-036-28W3/00	746.2	847.7	843.5		0		0	833.9	9.6		0
111/03-02-036-28W3/00	720.9	830.2	826.3	823.7	2.6		0		0		0
101/07-02-036-28W3/00	720.9	826.0	823.6		0		0	812.6	11		0
101/09-02-036-28W3/00	717.5	818.4	815.2		0		0	807.7	7.5		0
121/08-03-036-28W3/00	732.8	844.5	841.3		0		0	824.9	16.4		0
101/10-15-036-28W3/00	725.1	856.2	855.6		0		0		0		0
111/11-15-036-28W3/00	730.0	828.4	821.8		0		0		0		0
111/04-16-036-28W3/00	725.0	853.3	850.9		0		0	842.1	8.8		0
111/16-21-036-28W3/00	732.1	839.0	833.5		0		0	830.3	3.2		0
121/09-23-036-28W3/00	674.2		769.2		0		0	761.7	7.5		0

APPENDIX C

FACIES AND FACIES ASSOCIATION TOPS FROM MARSH AND LOVE (2014)

Well I.D.	KB (m)	B. Valley TVD (m)	B. Valley SS (m)	F1Low. TVD (m)	F1Low. ISO (m)	Mid. Bkn TVD (m)	F1 Up. TVD (m)	F1 Up. ISO (m)	Miss. TVD (m)	Miss. ISO (m)	SubMesU. TVD (m)	SubMesU. SS (m)
101/10-28-025-18W3/00	661.7								890.3		890.3	-228.6
101/01-22-026-18W3/00	664.2	923.0	-258.8	903.3	19.7	881.9	874.7	7.2	834.2	40.5	834.2	-170.0
101/11-09-027-18W3/00	661.7	910.6	-248.9	891.4	19.2	867.0	864.0	3	845.0	19	845.0	-183.3
101/10-17-027-18W3/00	665.7	889.3	-223.6	875.1	14.2	846.8	844.5	2.3	830.0	14.5	830.0	-164.3
101/11-23-027-18W3/00	634.3	828.2	-193.9	823.5	4.7	817.0	813.5	3.5	795.0	18.5	795.0	-160.7
101/10-28-027-18W3/00	646.2	866.7	-220.5	853.6	13.1	825.3	822.0	3.3	805.3	16.7	805.3	-159.1
131/14-21-029-18W3/00	730.3	908.3	-178	899.2	9.1	879.0	877.8	1.2	868.4	9.4	868.4	-138.1
101/08-15-030-18W3/00	685.2	911.9	-226.7	901.4	10.5	878.2	874.5	3.7	865.3	9.2	865.3	-180.1
130/10-12-031-18W3/00	696.8	872.2	-175.4	856.6	15.6	826.1	823.5	2.6	816.0	7.5	816.0	-119.2
101/06-16-031-18W3/00	718.7	881.9	-163.2	869.4	12.5	837.6	834.6	3	827.0	7.6	827.0	-108.3
131/03-04-032-18W3/00	639.2								706.1		706.1	-66.9
101/13-08-032-18W3/00	625.4								695.2		695.2	-69.8
191/10-09-032-18W3/00	619.6	745.2	-125.6	735.7	9.5	726.1	722.1	4	689.3	32.8	689.3	-69.7
101/12-13-032-18W3/00	643.0								706.0		706.0	-63.0
101/01-15-032-18W3/00	643.7	758.7	-115	749.6	9.1	734.5	730.4	4.1	703.4	27	703.4	-59.7
111/09-21-032-18W3/00	637.9	730.9	-93	729.0	1.9	713.1	709.0	4.1	694.5	14.5	694.5	-56.6
101/05-23-032-18W3/00	643.0								698.0		698.0	-55.0
101/07-23-032-18W3/00	643.1	805.6	-162.5	800.1	5.5	780.9	774.0	6.9	715.5	58.5	715.5	-72.4
101/06-29-032-18W3/00	618.0								660.2		660.2	-42.2
101/05-11-033-18W3/00	639.2			746.1	2.8			0		0	746.1	-106.9
111/03-10-034-18W3/00	704.4				0			0		0	831.0	-126.6
131/05-17-034-18W3/00	720.9				0			0		0	848.8	-127.9
111/15-26-034-18W3/00	699.2				0			0		0	815.5	-116.3
111/08-32-034-18W3/00	695.9				0			0		0	814.8	-118.9
101/16-11-035-18W3/00	690.4				0			0		0	825.0	-134.6
131/13-18-035-18W3/00	680.9				0			0		0	790.5	-109.6
161/04-21-035-18W3/00	682.4				0			0		0	794.3	-111.9
101/16-22-035-18W3/00	702.0				0			0		0	816.8	-114.8
102/16-22-035-18W3/00	705.0				0			0		0	819.0	-114.0
161/04-24-035-18W3/00	708.4				0			0		0	837.3	-128.9
121/05-28-035-18W3/00	685.8				0			0		0	795.0	-109.2
111/08-30-035-18W3/00	673.2				0			0		0	776.7	-103.5
101/16-30-035-18W3/00	682.4				0			0		0	791.8	-109.4
111/01-33-035-18W3/00	681.1				0			0		0	792.4	-111.3
111/08-35-035-18W3/00	688.2				0			0		0	813.0	-124.8
131/12-35-035-18W3/00	672.5				0			0		0	793.0	-120.5
141/09-36-035-18W3/00	691.6				0			0		0	808.5	-116.9
101/11-02-036-18W3/00	680.0				0			0		0	803.3	-123.3
130/11-12-036-18W3/00	678.5				0			0		0	787.6	-109.1
130/13-16-036-18W3/00	677.0				0			0		0	778.0	-101.0
131/10-36-037-18W3/00	679.1				0			0		0	761.0	-81.9
141/10-36-037-18W3/00	677.9				0			0		0	763.9	-86.0
121/15-36-037-18W3/00	679.1				0			0		0	762.3	-83.2
101/08-03-038-18W3/00	660.8				0			0		0	730.8	-70.0
101/04-06-038-18W3/00	676.7				0			0		0	742.7	-66.0
101/03-09-038-18W3/00	661.7				0			0		0	726.7	-65.0
161/13-11-038-18W3/00	666.0				0			0		0	747.0	-81.0
101/01-24-038-18W3/00	674.2				0			0		0	765.9	-91.7
111/15-34-038-18W3/00	705.9				0			0		0	768.0	-62.1
101/16-34-038-18W3/00	704.1				0			0		0	769.0	-64.9
101/08-04-039-18W3/00	687.0				0			0		0	730.0	-43.0
101/13-19-039-18W3/00	673.6				0			0		0	732.4	-58.8
101/01-25-039-18W3/00	689.5				0			0		0	780.0	-90.5
101/02-29-039-18W3/00	669.0				0			0		0	722.4	-53.4
101/01-36-039-18W3/00	689.8				0			0		0	754.0	-64.2
140/04-02-026-19W3/00	672.1	945.9	-273.8	929.0	16.9	910.7	907.2	3.5	890.3	16.9	890.3	-218.2
101/06-29-026-19W3/00	688.2	945.0	-256.8	928.4	16.6	907.2	903.7	3.5	891.5	12.2	891.5	-203.3
101/01-16-027-19W3/00	684.3	873.4	-189.1	871.1	2.3	864.1	862.8	1.3		0	862.8	-178.5
131/04-18-031-19W3/00	699.9	845.2	-145.3	837.8	7.4	813.0	811.0	2	787.8	23.2	787.8	-87.9
141/09-33-031-19W3/00	651.6	787.5	-135.9	776.3	11.2	764.0	759.8	4.2	723.0	36.8	723.0	-71.4
101/16-08-032-19W3/00	629.0								705.4		705.4	-76.4
101/15-09-032-19W3/00	626.8								690.1		690.1	-63.3
101/04-13-032-19W3/00	630.6								687.5		687.5	-56.9
101/04-15-032-19W3/00	622.1								687.5		687.5	-65.4
131/01-23-032-19W3/00	614.2				0			0		0	673.1	-58.9
101/04-32-032-19W3/00	626.9				0			0		0	759.7	-132.8
101/05-21-033-19W3/00	642.5	765.7	-123.2		0			0		0	765.7	-123.2
111/01-36-033-19W3/00	649.8				0			0		0	765.1	-115.3
101/08-07-034-19W3/00	626.1				0			0		0	751.0	-124.9
121/07-09-034-19W3/00	685.8				0			0		0	801.0	-115.2
111/09-17-034-19W3/00	700.4				0			0		0	829.0	-128.6
111/08-21-034-19W3/00	705.0				0			0		0	819.0	-114.0
141/13-21-034-19W3/00	707.4				0			0		0	822.0	-114.6
121/04-30-034-19W3/00	699.8				0			0		0	827.0	-127.2
121/09-30-034-19W3/00	703.5				0			0		0	829.5	-126.0
121/09-05-035-19W3/00	682.8				0			0		0	800.1	-117.3
141/16-14-035-19W3/00	682.4				0			0		0	794.0	-111.6

Well I.D.	KB (m)	B. Valley TVD (m)	B. Valley SS (m)	F1Low. TVD (m)	F1Low. ISO (m)	Mid. Bkn TVD (m)	F1 Up. TVD (m)	F1 Up. ISO (m)	Miss. TVD (m)	Miss. ISO (m)	SubMesU. TVD (m)	SubMesU. SS (m)
121/01-24-035-19W3/00	681.3				0			0		0	789.8	-108.5
101/13-24-036-19W3/00	674.5				0			0		0	759.0	-84.5
101/03-28-036-19W3/00	666.0				0			0		0	761.0	-95.0
101/08-01-037-19W3/00	657.1				0			0		0	738.1	-81.0
101/11-08-037-19W3/00	656.8				0			0		0	731.0	-74.2
101/14-21-037-19W3/00	683.4				0			0		0	755.0	-71.6
101/13-24-037-19W3/00	666.9				0			0		0	748.2	-81.3
131/10-29-037-19W3/00	678.8				0			0		0	745.7	-66.9
101/02-30-037-19W3/00	674.8				0			0		0	748.5	-73.7
121/03-07-038-19W3/00	662.3				0			0		0	722.0	-59.7
121/02-17-038-19W3/00	668.4				0			0		0	731.5	-63.1
131/02-18-038-19W3/00	665.1				0			0		0	722.7	-57.6
111/06-12-039-19W3/00	663.2				0			0		0	716.9	-53.7
101/12-17-039-19W3/00	653.8				0			0		0	717.2	-63.4
101/07-13-025-20W3/00	675.4	967.1	-291.7	949.9	17.2	937.2	933.0	4.2	881.5	51.5	881.5	-206.1
101/07-29-025-20W3/00	683.4			946.4		926.3	920.2	6.1	871.1	49.1	871.1	-187.7
150/07-34-025-20W3/00	683.4	956.7	-273.3	945.8	10.9	923.9	922.6	1.3	908.3	14.3	908.3	-224.9
101/10-13-029-20W3/00	720.5			898.5		876.9		0	874.5	2.4	874.5	-154.0
121/12-03-031-20W3/00	698.9	856.5	-157.6	847.1	9.4	821.9	820.3	1.6	806.0	14.3	806.0	-107.1
111/13-23-031-20W3/00	708.1	859.0	-150.9	852.2	6.8	836.1	833.3	2.8	806.1	27.2	806.1	-98.0
101/16-01-032-20W3/00	633.5	768.5	-135	760.3	8.2	750.0	745.1	4.9	717.0	28.1	717.0	-83.5
101/04-29-032-20W3/00	640.4	745.4	-105	733.4	12	718.7	716.9	1.8		0	716.9	-76.5
101/13-02-033-20W3/00	641.9				0			0		0	782.0	-140.1
141/07-10-033-20W3/00	645.5				0			0		0	791.5	-146.0
101/05-14-033-20W3/00	643.1				0			0		0	764.8	-121.7
131/05-16-033-20W3/00	642.2				0			0		0	783.0	-140.8
111/04-19-033-20W3/00	654.4				0			0		0	773.8	-119.4
101/04-27-034-20W3/00	695.9				0			0		0	823.2	-127.3
101/03-30-034-20W3/00	697.1				0			0		0	821.4	-124.3
131/14-30-034-20W3/00	696.8				0			0		0	811.2	-114.4
101/08-33-034-20W3/00	620.6				0			0		0	752.8	-132.2
111/16-35-034-20W3/00	693.9				0			0		0	811.1	-117.2
121/16-35-034-20W3/00	686.4				0			0		0	808.6	-122.2
111/13-36-034-20W3/00	684.6				0			0		0	807.6	-123.0
131/15-01-035-20W3/00	668.8				0			0		0	774.9	-106.1
121/05-24-035-20W3/00	662.3				0			0		0	766.1	-103.8
101/06-22-036-20W3/00	670.9				0			0		0	753.2	-82.3
121/04-29-036-20W3/00	658.4				0			0		0	741.2	-82.8
141/10-08-037-20W3/00	647.1				0			0		0	718.0	-70.9
131/08-09-037-20W3/00	645.3				0			0		0	716.0	-70.7
101/06-24-037-20W3/00	657.8				0			0		0	722.0	-64.2
101/13-34-037-20W3/00	663.2				0			0		0	717.5	-54.3
101/11-10-038-20W3/00	659.9				0			0		0	713.8	-53.9
101/16-13-038-20W3/00	662.9				0			0		0	713.0	-50.1
101/16-23-038-20W3/00	660.2				0			0		0	716.9	-56.7
101/08-24-038-20W3/00	661.7				0			0		0	716.3	-54.6
111/13-36-038-20W3/00	656.8				0			0		0	718.3	-61.5
101/11-20-039-20W3/00	665.4				0			0		0	737.0	-71.6
101/07-30-039-20W3/00	671.2				0			0		0	744.5	-73.3
141/07-32-039-20W3/00	670.3				0			0		0	738.1	-67.8
101/11-35-025-21W3/00	666.6	943.0	-276.4	929.4	13.6	905.2	901.7	3.5	891.0	10.7	891.0	-224.4
101/10-16-027-21W3/00	712.6	948.1	-235.5	938.8	9.3	923.6	921.3	2.3	916.8	4.5	916.8	-204.2
101/11-17-027-21W3/00	706.5	941.4	-234.9	931.7	9.7	906.8	903.4	3.4	900.7	2.7	900.7	-194.2
101/07-25-027-21W3/00	698.7					893.9	892.5	1.4	890.3	2.2	890.3	-191.6
101/10-29-027-21W3/00	721.2								878.8		878.8	-157.6
101/07-19-028-21W3/00	722.4	952.9	-230.5	940.0	12.9	918.7		0	887.4	31.3	887.4	-165.0
101/04-03-030-21W3/00	684.9	871.6	-186.7	868.1	3.5	854.0	850.7	3.3	841.6	9.1	841.6	-156.7
101/12-30-030-21W3/00	675.3	842.6	-167.3	834.5	8.1	812.5	809.1	3.4	798.7	10.4	798.7	-123.4
102/12-21-031-21W3/00	684.8	833.3	-148.5	825.2	8.1	810.9	807.9	3	794.3	13.6	794.3	-109.5
111/13-09-032-21W3/00	699.2	821.1	-121.9	812.1	9	789.9	784.4	5.5	754.7	29.7	754.7	-55.5
101/09-16-032-21W3/00	704.7	831.0	-126.3	822.0	9	796.9	791.4	5.5	754.7	36.7	754.7	-50.0
101/07-19-032-21W3/00	695.4								745.0		745.0	-49.6
121/06-25-032-21W3/00	651.8								715.0		715.0	-63.2
111/11-27-032-21W3/00	689.5	799.5	-110	790.0	9.5	775.0	769.0	6	766.5	2.5	766.5	-77.0
141/01-32-032-21W3/00	701.2	800.0	-98.8	791.1	8.9	771.5	766.5	5	765.0	1.5	765.0	-63.8
101/01-35-032-21W3/00	663.8			756.2		748.3		0	746.2	2.1	746.2	-82.4
101/04-36-032-21W3/00	657.5	755.3	-97.8	741.0	14.3	722.5	720.1	2.4		0	715.0	-57.5
121/01-17-033-21W3/00	666.3	748.8	-82.5		0			0		0	748.8	-82.5
101/09-19-033-21W3/00	672.4				0			0		0	779.0	-106.6
101/12-20-033-21W3/00	670.6				0			0		0	774.3	-103.7
101/01-24-033-21W3/00	651.4				0			0		0	769.2	-117.8
111/01-30-033-21W3/00	670.4				0			0		0	775.2	-104.8
111/03-30-033-21W3/00	669.6				0			0		0	782.3	-112.7
101/12-02-034-21W3/00	680.6				0			0		0	798.7	-118.1
101/05-16-034-21W3/00	671.5				0			0		0	774.8	-103.3
101/13-18-034-21W3/00	669.0				0			0		0	771.3	-102.3
111/16-24-034-21W3/00	696.9				0			0		0	805.7	-108.8
101/02-29-034-21W3/00	681.2				0			0		0	796.9	-115.7

Well I.D.	KB (m)	B. Valley TVD (m)	B. Valley SS (m)	F1Low. TVD (m)	F1Low. ISO (m)	Mid. Bkn TVD (m)	F1 Up. TVD (m)	F1 Up. ISO (m)	Miss. TVD (m)	Miss. ISO (m)	SubMesU. TVD (m)	SubMesU. SS (m)
131/13-35-034-21W3/00	690.1				0			0		0	792.3	-102.2
101/13-13-035-21W3/00	676.4				0			0		0	772.9	-96.5
102/13-13-035-21W3/00	685.7				0			0		0	755.4	-69.7
111/12-22-035-21W3/00	677.9				0			0		0	762.0	-84.1
101/06-24-035-21W3/00	652.9				0			0		0	740.1	-87.2
101/07-19-036-21W3/00	686.1				0			0		0	768.5	-82.4
101/11-23-036-21W3/00	670.3				0			0		0	752.0	-81.7
121/09-18-037-21W3/00	654.1				0			0		0	760.2	-106.1
111/04-29-037-21W3/00	657.0				0			0		0	755.5	-98.5
101/10-11-038-21W3/00	672.7				0			0		0	756.5	-83.8
101/05-18-038-21W3/00	643.4				0			0		0	709.6	-66.2
101/07-13-039-21W3/00	666.6				0			0		0	747.5	-80.9
101/11-29-039-21W3/00	641.0				0			0		0	719.0	-78.0
101/10-34-039-21W3/00	666.0				0			0		0	739.8	-73.8
121/10-07-025-22W3/00	724.4								965.5		965.5	-241.1
101/06-29-025-22W3/00	686.7			955.7		933.7	930.2	3.5	901.3	28.9	901.3	-214.6
101/10-24-026-22W3/00	694.6	963.2	-268.6	948.3	14.9	923.4		0		0	923.4	-228.8
101/07-29-027-22W3/00	712.0			928.0		899.2	895.6	3.6	875.7	19.9	875.7	-163.7
101/01-04-028-22W3/00	733.3	953.8	-220.5	944.8	9	920.1	917.2	2.9	865.9	51.3	865.9	-132.6
111/16-11-028-22W3/00	744.6	958.0	-213.4	944.0	14	915.0		0	900.0	15	900.0	-155.4
101/11-16-028-22W3/00	732.4	965.3	-232.9	954.3	11	928.1	926.3	1.8	909.5	16.8	909.5	-177.1
101/07-24-028-22W3/00	745.5	967.6	-222.1	954.0	13.6	928.1	924.2	3.9	905.0	19.2	905.0	-159.5
121/13-31-028-22W3/00	706.8	927.0	-220.2	916.0	11	898.5		0		0	898.5	-191.7
101/06-03-029-22W3/00	719.3	935.7	-216.4	923.4	12.3	905.0		0	892.9	12.1	892.9	-173.6
101/07-31-029-22W3/00	722.4	921.3	-198.9	912.5	8.8	898.1	896.0	2.1	884.5	11.5	884.5	-162.1
131/16-33-029-22W3/00	707.4	903.4	-196	894.5	8.9	888.0		0		0	888.0	-180.6
141/10-26-031-22W3/00	685.9	820.2	-134.3	813.2	7	795.9	793.1	2.8	772.0	21.1	772.0	-86.1
121/07-34-031-22W3/00	687.1	815.4	-128.3	809.1	6.3	792.0	789.4	2.6	766.6	22.8	766.6	-79.5
150/07-08-032-22W3/00	690.1	803.4	-113.3	797.5	5.9	776.3	774.3	2	748.0	26.3	748.0	-57.9
111/09-09-032-22W3/00	686.9	810.1	-123.2	803.6	6.5	790.2		0	756.5	33.7	756.5	-69.6
111/15-09-032-22W3/00	684.2								752.7		752.7	-68.5
121/16-18-032-22W3/00	689.8	803.9	-114.1	797.2	6.7	791.5	786.7	4.8	739.8	46.9	739.8	-50.0
121/16-22-032-22W3/00	687.4								730.1		730.1	-42.7
131/11-25-032-22W3/00	699.0	805.1	-106.1	797.5	7.6	778.7	775.8	2.9	745.5	30.3	745.5	-46.5
101/10-33-032-22W3/00	682.7								738.0		738.0	-55.3
131/11-01-033-22W3/00	685.8	783.0	-97.2	777.0	6	761.5	757.6	3.9	748.7	8.9	748.7	-62.9
111/13-01-033-22W3/00	686.4								720.2		720.2	-33.8
101/09-02-033-22W3/00	683.7	773.1	-89.4	767.1	6	751.4	747.1	4.3	736.8	10.3	736.8	-53.1
101/13-08-033-22W3/00	683.8				0			0		0	808.7	-124.9
101/16-10-033-22W3/00	684.3	764.1	-79.8		0			0		0	764.1	-79.8
141/04-34-033-22W3/00	659.9				0			0		0	761.9	-102.0
111/05-34-033-22W3/00	659.9				0			0		0	763.9	-104.0
191/05-34-033-22W3/00	662.3				0			0		0	773.1	-110.8
121/06-34-033-22W3/00	659.9				0			0		0	772.1	-112.2
121/02-02-034-22W3/00	657.1				0			0		0	765.0	-107.9
131/16-10-034-22W3/00	655.9				0			0		0	750.5	-94.6
101/16-13-034-22W3/00	674.2				0			0		0	770.7	-96.5
111/02-29-034-22W3/00	661.7				0			0		0	772.0	-110.3
101/10-16-035-22W3/00	657.8				0			0		0	747.7	-89.9
121/12-22-035-22W3/00	658.1				0			0		0	745.2	-87.1
101/10-17-036-22W3/00	701.0				0			0		0	771.8	-70.8
111/11-25-036-22W3/00	663.1	727.8	-64.7		0			0		0	727.8	-64.7
101/07-27-036-22W3/00	661.1	731.1	-70		0			0		0	731.1	-70.0
101/08-14-037-22W3/00	640.1				0			0		0	719.3	-79.2
141/15-23-037-22W3/00	638.6				0			0		0	719.0	-80.4
111/05-35-037-22W3/00	661.4				0			0		0	726.2	-64.8
111/03-09-038-22W3/00	628.8				0			0		0	715.4	-86.6
141/08-10-038-22W3/00	617.0				0			0		0	705.2	-88.2
101/10-16-038-22W3/00	577.0				0			0		0	653.2	-76.2
111/14-24-038-22W3/00	631.2				0			0		0	708.0	-76.8
141/14-28-038-22W3/00	574.2				0			0		0	634.5	-60.3
101/10-03-039-22W3/00	571.2				0			0		0	645.5	-74.3
111/15-11-039-22W3/00	629.7				0			0		0	700.4	-70.7
111/04-12-039-22W3/00	618.5				0			0		0	695.0	-76.5
101/01-16-039-22W3/00	646.5				0			0		0	719.5	-73.0
111/05-22-039-22W3/00	641.0				0			0		0	697.2	-56.2
101/10-22-039-22W3/00	641.8				0			0		0	701.9	-60.1
141/02-28-039-22W3/00	635.7				0			0		0	694.5	-58.8
101/06-29-039-22W3/00	640.7				0			0		0	698.8	-58.1
101/07-29-025-23W3/00	687.0			957.8		935.8	930.3	5.5	911.4	18.9	911.4	-224.4
101/11-30-027-23W3/00	674.8	891.5	-216.7	890.2	1.3	859.1	858.1	1	816.3	41.8	816.3	-141.5
101/07-06-029-23W3/00	680.6	905.3	-224.7	896.9	8.4	873.0	871.6	1.4	857.1	14.5	857.1	-176.5
101/06-12-029-23W3/00	692.8	916.0	-223.2	906.8	9.2	899.0		0		0	899.0	-206.2
111/07-08-030-23W3/00	695.2	883.0	-187.8	876.0	7	855.3	854.9	0.4	819.6	35.3	819.6	-124.4
101/16-13-030-23W3/00	704.7	874.9	-170.2	867.4	7.5	853.6	851.4	2.2	837.3	14.1	837.3	-132.6
111/01-29-030-23W3/00	693.4	851.2	-157.8	841.6	9.6	825.1	822.5	2.6	814.0	8.5	814.0	-120.6
131/03-31-030-23W3/00	695.8	845.9	-150.1	838.8	7.1	815.6	812.6	3	799.9	12.7	799.9	-104.1
111/04-31-030-23W3/00	696.4					823.9	820.2	3.7	806.7	13.5	806.7	-110.3

Well I.D.	KB (m)	B. Valley TVD (m)	B. Valley SS (m)	F1Low. TVD (m)	F1Low. ISO (m)	Mid. Bkn TVD (m)	F1 Up. TVD (m)	F1 Up. ISO (m)	Miss. TVD (m)	Miss. ISO (m)	SubMesU. TVD (m)	SubMesU. SS (m)
131/04-31-030-23W3/00	697.6	854.4	-156.8	847.2	7.2	823.4	821.3	2.1	807.3	14	807.3	-109.7
111/12-35-030-23W3/00	691.4	851.0	-159.6	843.5	7.5	834.9	829.6	5.3	815.2	14.4	815.2	-123.8
131/02-02-031-23W3/00	692.5	847.7	-155.2	841.6	6.1	828.5	825.9	2.6	817.3	8.6	817.3	-124.8
141/13-03-031-23W3/00	693.0	837.7	-144.7	830.9	6.8	819.5	813.8	5.7	798.8	15	798.8	-105.8
121/11-17-031-23W3/00	710.0	854.5	-144.5	847.5	7	839.8	836.5	3.3	813.0	23.5	813.0	-103.0
122/12-20-031-23W3/00	707.2	829.9	-122.7	824.4	5.5	803.7	802.8	0.9	778.3	24.5	778.3	-71.1
121/12-21-031-23W3/00	700.1			819.6		801.5	796.7	4.8	779.7	17	779.7	-79.6
141/05-28-031-23W3/00	700.4	816.2	-115.8	811.7	4.5	792.5	787.9	4.6	769.2	18.7	769.2	-68.8
101/05-30-031-23W3/00	716.6	839.1	-122.5	832.4	6.7	814.6	811.5	3.1	776.4	35.1	776.4	-59.8
101/15-31-031-23W3/00	709.0	858.8	-149.8	856.2	2.6	838.3	836.6	1.7	822.4	14.2	822.4	-113.4
101/12-02-032-23W3/00	704.1	829.3	-125.2	823.4	5.9			0	788.7	34.7	788.7	-84.6
141/12-02-032-23W3/00	706.6								791.0		791.0	-84.4
131/14-02-032-23W3/00	701.1	823.9	-122.8	817.6	6.3			0	785.8	31.8	785.8	-84.7
111/15-02-032-23W3/00	698.0	828.5	-130.5	823.6	4.9			0	796.3	27.3	796.3	-98.3
111/10-07-032-23W3/00	719.6	851.2	-131.6	847.5	3.7	835.8		0		0	835.8	-116.2
111/07-10-032-23W3/00	715.7	827.9	-112.2	824.5	3.4	817.1	813.6	3.5	801.9	11.7	801.9	-86.2
111/14-10-032-23W3/00	705.6	825.0	-119.4	822.9	2.1	815.3	812.9	2.4	791.3	21.6	791.3	-85.7
121/06-11-032-23W3/00	700.4	830.5	-130.1	825.4	5.1	817.2		0	794.5	22.7	794.5	-94.1
101/10-13-032-23W3/00	690.7	814.6	-123.9	809.2	5.4	800.4	797.4	3	769.6	27.8	769.6	-78.9
131/11-13-032-23W3/00	690.3	813.5	-123.2	810.0	3.5	801.5	797.0	4.5	770.1	26.9	770.1	-79.8
121/05-15-032-23W3/00	716.7	867.5	-150.8		0	860.0		0	839.9	20.1	839.9	-123.2
101/14-17-032-23W3/00	706.2	869.9	-163.7	867.2	2.7	844.6	840.8	3.8		0	840.8	-134.6
121/06-21-032-23W3/00	707.3				0			0		0	893.3	-186.0
101/08-23-032-23W3/00	693.1	819.2	-126.1		0			0		0	819.2	-126.1
111/09-28-032-23W3/00	711.8				0			0		0	883.0	-171.2
121/05-31-032-23W3/00	715.2	878.1	-162.9	875.2	2.9	868.2	862.8	5.4		0	862.8	-147.6
111/15-35-032-23W3/00	695.0	843.9	-148.9	842.4	1.5	831.1		0		0	831.1	-136.1
101/12-05-033-23W3/00	702.3	846.0	-143.7		0			0		0	846.0	-143.7
101/04-06-033-23W3/00	710.2	856.3	-146.1		0			0		0	856.3	-146.1
111/16-08-033-23W3/00	697.8					845.7	844.7	1	837.6	7.1	837.6	-139.8
111/05-15-033-23W3/00	698.7					856.3	853.8	2.5	832.6	21.2	832.6	-133.9
101/13-19-033-23W3/00	698.6	836.8	-138.2		0			0		0	836.8	-138.2
111/10-22-033-23W3/00	695.8	836.9	-141.1		0			0		0	836.9	-141.1
111/11-26-033-23W3/00	701.0				0			0		0	843.0	-142.0
111/12-02-034-23W3/00	700.0				0			0		0	824.5	-124.5
101/11-03-034-23W3/00	718.7	836.1	-117.4		0			0		0	836.1	-117.4
111/10-04-034-23W3/00	722.1			852.5	2.5	840.2		0		0	840.2	-118.1
101/02-08-034-23W3/00	695.2			827.3	2.9	818.0		0		0	818.0	-122.8
111/01-20-034-23W3/00	678.5	792.5	-114	785.8	6.7	770.2	769.3	0.9		0	769.3	-90.8
101/10-09-036-23W3/00	684.0				0			0		0	762.6	-78.6
101/07-27-036-23W3/00	701.6				0			0		0	783.3	-81.7
151/04-29-036-23W3/00	712.3				0			0		0	796.2	-83.9
151/04-30-036-23W3/00	707.1				0			0		0	805.2	-98.1
101/10-31-036-23W3/00	714.5				0			0		0	795.8	-81.3
141/08-13-037-23W3/00	678.2				0			0		0	750.7	-72.5
101/10-20-037-23W3/00	688.5				0			0		0	754.6	-66.1
141/13-33-037-23W3/00	662.6				0			0		0	718.5	-55.9
121/02-02-038-23W3/00	688.8				0			0		0	750.5	-61.7
101/06-06-038-23W3/00	670.9				0			0		0	716.5	-45.6
111/13-07-038-23W3/00	669.7				0			0		0	718.4	-48.7
101/15-07-038-23W3/00	673.3				0			0		0	719.9	-46.6
111/11-08-038-23W3/00	662.1				0			0		0	709.1	-47.0
101/05-16-038-23W3/00	659.0				0			0		0	702.9	-43.9
111/03-17-038-23W3/00	662.1				0			0		0	701.7	-39.6
111/04-17-038-23W3/00	664.8				0			0		0	707.6	-42.8
101/05-17-038-23W3/00	665.1				0			0		0	706.9	-41.8
111/06-17-038-23W3/00	666.4				0			0		0	704.7	-38.3
101/12-17-038-23W3/00	665.7				0			0		0	708.6	-42.9
111/13-17-038-23W3/00	667.9				0			0		0	712.5	-44.6
111/01-18-038-23W3/00	665.4				0			0		0	708.6	-43.2
111/07-18-038-23W3/00	670.9				0			0		0	715.0	-44.1
111/08-18-038-23W3/00	668.4				0			0		0	711.3	-42.9
111/09-18-038-23W3/00	670.0				0			0		0	716.2	-46.2
121/11-18-038-23W3/00	671.8				0			0		0	715.2	-43.4
111/15-18-038-23W3/00	668.2				0			0		0	711.2	-43.0
111/16-18-038-23W3/00	665.1				0			0		0	708.5	-43.4
111/07-19-038-23W3/00	673.9				0			0		0	710.0	-36.1
111/14-20-038-23W3/00	660.2				0			0		0	699.2	-39.0
101/07-23-038-23W3/00	632.2				0			0		0	691.0	-58.8
111/01-24-038-23W3/00	594.0				0			0		0	666.8	-72.8
101/10-29-038-23W3/00	655.3				0			0		0	694.7	-39.4
111/10-30-038-23W3/00	660.5				0			0		0	696.1	-35.6
121/07-31-038-23W3/00	669.1				0			0		0	706.5	-37.4
101/10-01-039-23W3/00	587.3				0			0		0	636.0	-48.7
111/16-01-039-23W3/00	575.6				0			0		0	634.5	-58.9
111/15-02-039-23W3/00	643.9				0			0		0	701.2	-57.3
111/05-05-039-23W3/00	677.0				0			0		0	714.5	-37.5
131/12-08-039-23W3/00	675.7				0			0		0	724.9	-49.2

Well I.D.	KB (m)	B. Valley TVD (m)	B. Valley SS (m)	F1Low. TVD (m)	F1Low. ISO (m)	Mid. Bkn TVD (m)	F1 Up. TVD (m)	F1 Up. ISO (m)	Miss. TVD (m)	Miss. ISO (m)	SubMesU. TVD (m)	SubMesU. SS (m)
131/05-14-039-23W3/00	603.5				0			0		0	647.6	-44.1
141/08-14-039-23W3/00	594.2				0			0		0	641.8	-47.6
111/13-14-039-23W3/00	592.5				0			0		0	625.2	-32.7
130/15-14-039-23W3/00	591.9				0			0		0	624.1	-32.2
101/16-14-039-23W3/00	590.4				0			0		0	623.4	-33.0
101/03-15-039-23W3/00	662.9				0			0		0	709.4	-46.5
111/11-17-039-23W3/00	668.3				0			0		0	715.1	-46.8
101/15-17-039-23W3/00	660.8				0			0		0	696.5	-35.7
141/03-18-039-23W3/00	678.2				0			0		0	712.5	-34.3
131/08-20-039-23W3/00	665.3				0			0		0	701.5	-36.2
140/05-22-039-23W3/00	616.3				0			0		0	661.7	-45.4
130/02-23-039-23W3/00	591.9				0			0		0	623.3	-31.4
111/05-23-039-23W3/00	591.3				0			0		0	635.2	-43.9
101/07-23-039-23W3/00	592.8				0			0		0	625.6	-32.8
101/11-24-039-23W3/00	597.4				0			0		0	638.8	-41.4
101/02-27-039-23W3/00	665.1				0			0		0	667.3	-2.2
111/13-28-039-23W3/00	663.9				0			0		0	717.7	-53.8
101/11-30-039-23W3/00	680.0				0			0		0	725.0	-45.0
121/10-33-039-23W3/00	661.0				0			0		0	720.1	-59.1
111/03-35-039-23W3/00	656.1				0			0		0	717.0	-60.9
101/11-06-025-24W3/00	709.3	998.8	-289.5	988.5	10.3	968.8	965.9	2.9	882.4	83.5	882.4	-173.1
101/04-32-026-24W3/00	744.9	989.1	-244.2	976.3	12.8	944.0	942.4	1.6		0	942.4	-197.5
101/16-04-027-24W3/00	717.2	956.5	-239.3	944.9	11.6	933.8		0	914.4	19.4	914.4	-197.2
141/07-21-027-24W3/00	711.2	943.7	-232.5	932.0	11.7	910.0		0	883.9	26.1	883.9	-172.7
121/12-14-029-24W3/00	688.5			885.3		863.1	862.0	1.1	850.0	12	850.0	-161.5
111/07-34-029-24W3/00	690.4	876.8	-186.4	868.1	8.7	854.0	851.0	3	842.2	8.8	842.2	-151.8
111/11-01-030-24W3/00	688.1	865.1	-177	857.5	7.6	844.0	840.0	4	810.1	29.9	810.1	-122.0
121/12-15-030-24W3/00	694.9	864.2	-169.3	857.6	6.6	841.8	840.2	1.6	809.6	30.6	809.6	-114.7
111/14-15-030-24W3/00	696.8	865.5	-168.7	860.0	5.5	845.5	844.5	1	810.8	33.7	810.8	-114.0
131/08-16-030-24W3/00	698.0	867.3	-169.3	860.0	7.3	844.1	842.9	1.2	806.3	36.6	806.3	-108.3
111/16-22-030-24W3/00	703.6	855.5	-151.9	850.5	5	838.0	836.5	1.5	794.5	42	794.5	-90.9
131/11-25-030-24W3/00	695.0	858.8	-163.8	851.3	7.5	831.8	830.0	1.8	816.0	14	816.0	-121.0
141/07-34-030-24W3/00	711.7	867.0	-155.3	860.5	6.5	852.5	850.3	2.2	828.1	22.2	828.1	-116.4
141/10-09-031-24W3/00	686.9	831.1	-144.2	825.1	6	803.7	800.5	3.2	784.2	16.3	784.2	-97.3
101/07-10-031-24W3/00	701.3			842.0		818.7	817.0	1.7	805.6	11.4	805.6	-104.3
131/09-18-031-24W3/00	702.2	840.8	-138.6	835.3	5.5	823.8	821.3	2.5	805.1	16.2	805.1	-102.9
101/07-19-031-24W3/00	675.7	814.9	-139.2	810.0	4.9	802.8	799.7	3.1	782.2	17.5	782.2	-106.5
121/12-21-031-24W3/00	702.2	834.3	-132.1	828.9	5.4	821.3	818.8	2.5	803.6	15.2	803.6	-101.4
141/01-23-031-24W3/00	712.3			836.7		816.2	811.7	4.5	790.3	21.4	790.3	-78.0
111/11-30-031-24W3/00	673.7	795.2	-121.5	790.6	4.6	775.6	775.0	0.6	753.0	22	753.0	-79.3
111/08-34-031-24W3/00	707.7	826.2	-118.5	820.8	5.4	815.2	811.4	3.8	800.0	11.4	800.0	-92.3
121/12-06-032-24W3/00	708.2	822.8	-114.6	818.2	4.6	810.6	807.3	3.3	774.4	32.9	774.4	-66.2
131/07-07-032-24W3/00	704.3	815.1	-110.8	809.9	5.2	797.5	795.5	2	771.8	23.7	771.8	-67.5
101/13-08-032-24W3/00	696.9	807.5	-110.6	803.5	4	789.9	787.5	2.4	761.7	25.8	761.7	-64.8
141/07-09-032-24W3/00	699.5	810.3	-110.8	805.5	4.8	793.0	791.5	1.5	771.5	20	771.5	-72.0
121/08-13-032-24W3/00	716.1	824.2	-108.1	820.1	4.1	813.2		0		0	813.2	-97.1
121/10-15-032-24W3/00	704.4	824.3	-119.9	820.0	4.3	812.5	809.2	3.3	793.8	15.4	793.8	-89.4
111/06-21-032-24W3/00	674.4	783.3	-108.9	778.4	4.9	767.2		0	753.3	13.9	753.3	-78.9
111/14-23-032-24W3/00	709.2	830.7	-121.5	825.1	5.6	816.4		0		0	816.4	-107.2
111/14-25-032-24W3/00	714.6	862.0	-147.4	858.1	3.9	847.0	841.8	5.2		0	841.8	-127.2
121/12-28-032-24W3/00	713.2	860.0	-146.8	857.5	2.5	844.8	840.3	4.5	814.0	26.3	814.0	-100.8
121/05-29-032-24W3/00	722.4	825.3	-102.9	820.2	5.1	811.6	809.2	2.4	790.2	19	790.2	-67.8
141/06-29-032-24W3/00	714.8	828.7	-113.9	823.2	5.5	813.3	810.3	3	793.6	16.7	793.6	-78.8
121/07-29-032-24W3/00	718.1	820.3	-102.2	815.6	4.7	808.0	806.5	1.5	798.1	8.4	798.1	-80.0
141/05-30-032-24W3/00	723.5	820.0	-96.5	815.5	4.5	806.0	803.5	2.5	784.5	19	784.5	-61.0
121/08-30-032-24W3/00	727.6	835.0	-107.4	829.5	5.5	820.0	817.0	3	797.0	20	797.0	-69.4
101/06-32-032-24W3/00	715.4	815.3	-99.9	810.2	5.1	803.5	801.2	2.3	799.6	1.6	799.6	-84.2
131/12-32-032-24W3/00	717.1	819.0	-101.9	814.5	4.5	807.5	805.0	2.5	801.5	3.5	801.5	-84.4
121/06-33-032-24W3/00	720.2	818.6	-98.4	814.3	4.3	810.1		0	784.2	25.9	784.2	-64.0
102/09-36-032-24W3/00	716.5	834.8	-118.3	832.6	2.2	815.0		0	786.5	28.5	786.5	-70.0
141/01-01-033-24W3/00	711.9	853.0	-141.1		0			0		0	853.0	-141.1
101/06-11-033-24W3/00	709.0	861.0	-152		0			0		0	861.0	-152.0
111/10-14-033-24W3/00	702.1	837.9	-135.8		0			0		0	837.9	-135.8
101/06-18-033-24W3/00	713.5	806.1	-92.6		0			0		0	806.1	-92.6
101/04-20-033-24W3/00	706.8	796.4	-89.6		0			0		0	796.4	-89.6
111/07-21-033-24W3/00	692.6	799.3	-106.7		0			0		0	799.3	-106.7
111/04-26-033-24W3/00	696.1	840.1	-144		0			0		0	840.1	-144.0
101/10-32-033-24W3/00	693.4	813.3	-119.9	809.7	3.6	805.8		0		0	805.8	-112.4
101/04-10-034-24W3/00	704.1	828.6	-124.5		0			0		0	828.6	-124.5
111/15-10-034-24W3/00	695.0	812.9	-117.9		0			0		0	812.9	-117.9
111/16-12-034-24W3/00	696.1				0			0		0	831.6	-135.5
101/04-13-034-24W3/00	692.5				0			0		0	826.3	-133.8
111/13-13-034-24W3/00	690.5				0			0		0	843.9	-153.4
101/09-14-034-24W3/00	692.0				0			0		0	822.7	-130.7
121/10-15-034-24W3/00	688.5			822.3	5.2	816.7		0		0	816.7	-128.2
101/13-17-034-24W3/00	692.7	807.0	-114.3	803.7	3.3	797.5		0		0	797.5	-104.8
131/15-20-034-24W3/00	688.0			829.7	2.8	822.1		0		0	822.1	-134.1
111/02-23-034-24W3/00	688.1				0			0		0	829.7	-141.6

Well I.D.	KB (m)	B. Valley TVD (m)	B. Valley SS (m)	F1Low. TVD (m)	F1Low. ISO (m)	Mid. Bkn TVD (m)	F1 Up. TVD (m)	F1 Up. ISO (m)	Miss. TVD (m)	Miss. ISO (m)	SubMesU. TVD (m)	SubMesU. SS (m)
111/02-24-034-24W3/00	687.3				0			0		0	826.0	-138.7
111/11-24-034-24W3/00	688.5				0			0		0	825.2	-136.7
111/10-30-034-24W3/00	692.2	800.4	-108.2	797.8	2.6	793.5		0		0	793.5	-101.3
111/02-36-034-24W3/00	683.7	779.8	-96.1		0			0		0	779.8	-96.1
101/01-08-035-24W3/00	686.7	790.0	-103.3		0			0		0	790.0	-103.3
101/10-27-035-24W3/00	681.8	797.8	-116		0			0		0	797.8	-116.0
102/10-27-035-24W3/00	683.0	806.5	-123.5		0			0		0	806.5	-123.5
151/04-29-035-24W3/00	676.4	751.6	-75.2	749.1	2.5	744.8	742.2	2.6		0	742.2	-65.8
101/10-11-036-24W3/00	702.6				0			0		0	777.8	-75.2
101/11-27-036-24W3/00	715.1				0			0		0	790.7	-75.6
121/09-29-036-24W3/00	723.8				0			0		0	813.3	-89.5
161/13-32-036-24W3/00	696.8				0			0		0	786.1	-89.3
141/10-33-036-24W3/00	706.8				0			0		0	782.6	-75.8
121/10-06-037-24W3/00	693.8				0			0		0	738.8	-45.0
141/15-10-037-24W3/00	683.3				0			0		0	747.5	-64.2
101/15-15-037-24W3/00	678.2				0			0		0	732.1	-53.9
111/16-15-037-24W3/00	681.7				0			0		0	736.4	-54.7
141/01-16-037-24W3/00	682.4				0			0		0	736.3	-53.9
121/10-21-037-24W3/00	668.0				0			0		0	717.7	-49.7
101/11-31-037-24W3/00	690.1				0			0		0	750.7	-60.6
111/07-34-037-24W3/00	688.4				0			0		0	743.3	-54.9
101/13-04-038-24W3/00	690.4				0			0		0	734.4	-44.0
111/13-05-038-24W3/00	688.5				0			0		0	733.2	-44.7
111/14-05-038-24W3/00	695.8				0			0		0	740.8	-45.0
111/09-06-038-24W3/00	692.0				0			0		0	737.6	-45.6
111/11-06-038-24W3/00	703.6				0			0		0	750.9	-47.3
111/14-06-038-24W3/00	691.3				0			0		0	737.0	-45.7
111/16-06-038-24W3/00	683.0				0			0		0	728.1	-45.1
111/01-07-038-24W3/00	692.6				0			0		0	737.4	-44.8
111/03-07-038-24W3/00	682.2				0			0		0	727.1	-44.9
111/05-07-038-24W3/00	687.6				0			0		0	732.0	-44.4
112/05-07-038-24W3/00	686.9				0			0		0	731.9	-45.0
111/06-07-038-24W3/00	689.1				0			0		0	734.1	-45.0
111/10-07-038-24W3/00	692.7				0			0		0	737.2	-44.5
111/12-07-038-24W3/00	690.3				0			0		0	733.9	-43.6
111/13-07-038-24W3/00	693.0				0			0		0	737.2	-44.2
111/14-07-038-24W3/00	696.3				0			0		0	743.2	-46.9
111/02-09-038-24W3/00	692.5				0			0		0	734.8	-42.3
111/03-09-038-24W3/00	693.7				0			0		0	735.7	-42.0
111/04-09-038-24W3/00	693.4				0			0		0	736.1	-42.7
111/07-09-038-24W3/00	694.9				0			0		0	736.5	-41.6
111/08-09-038-24W3/00	695.9				0			0		0	738.2	-42.3
111/09-09-038-24W3/00	693.9				0			0		0	736.0	-42.1
111/10-09-038-24W3/00	696.5				0			0		0	738.3	-41.8
111/11-09-038-24W3/00	699.4				0			0		0	740.1	-40.7
111/12-09-038-24W3/00	698.2				0			0		0	735.0	-36.8
131/15-09-038-24W3/00	697.4				0			0		0	739.0	-41.6
111/04-10-038-24W3/00	689.1				0			0		0	733.9	-44.8
111/05-10-038-24W3/00	692.2				0			0		0	736.0	-43.8
101/10-10-038-24W3/00	689.8				0			0		0	734.7	-44.9
111/11-10-038-24W3/00	693.0				0			0		0	735.6	-42.6
112/11-10-038-24W3/00	690.9				0			0		0	732.4	-41.5
111/12-10-038-24W3/00	691.7				0			0		0	732.9	-41.2
111/14-10-038-24W3/00	695.3				0			0		0	736.8	-41.5
111/15-11-038-24W3/00	689.8				0			0		0	727.1	-37.3
191/02-12-038-24W3/00	671.5				0			0		0	716.9	-45.4
121/04-12-038-24W3/00	678.2				0			0		0	725.5	-47.3
111/07-12-038-24W3/00	679.0				0			0		0	725.5	-46.5
141/07-13-038-24W3/00	685.9				0			0		0	723.1	-37.2
101/12-13-038-24W3/00	691.6				0			0		0	729.1	-37.5
101/10-14-038-24W3/00	694.6				0			0		0	732.9	-38.3
131/12-15-038-24W3/00	701.5				0			0		0	738.6	-37.1
131/11-16-038-24W3/00	695.7				0			0		0	737.3	-41.6
111/02-17-038-24W3/00	698.8				0			0		0	741.7	-42.9
111/06-17-038-24W3/00	701.7				0			0		0	743.4	-41.7
101/11-18-038-24W3/00	705.0				0			0		0	745.5	-40.5
141/14-18-038-24W3/00	700.7				0			0		0	743.8	-43.1
131/11-19-038-24W3/00	700.1				0			0		0	741.8	-41.7
131/08-21-038-24W3/00	692.1				0			0		0	731.0	-38.9
131/05-22-038-24W3/00	695.9				0			0		0	735.1	-39.2
101/06-22-038-24W3/00	695.2				0			0		0	735.0	-39.8
131/08-22-038-24W3/00	695.6				0			0		0	733.7	-38.1
141/02-23-038-24W3/00	694.9				0			0		0	732.1	-37.2
111/06-26-038-24W3/00	689.2				0			0		0	724.3	-35.1
111/07-27-038-24W3/00	693.9				0			0		0	746.2	-52.3
101/04-28-038-24W3/00	695.6				0			0		0	734.0	-38.4
121/06-28-038-24W3/00	694.5				0			0		0	732.1	-37.6
111/07-30-038-24W3/00	695.6				0			0		0	741.0	-45.4

Well I.D.	KB (m)	B. Valley TVD (m)	B. Valley SS (m)	F1Low. TVD (m)	F1Low. ISO (m)	Mid. Bkn TVD (m)	F1 Up. TVD (m)	F1 Up. ISO (m)	Miss. TVD (m)	Miss. ISO (m)	SubMesU. TVD (m)	SubMesU. SS (m)
111/14-34-038-24W3/00	696.3				0			0		0	732.8	-36.5
121/11-35-038-24W3/00	688.0				0			0		0	723.9	-35.9
101/07-36-038-24W3/00	677.6				0			0		0	720.7	-43.1
111/13-02-039-24W3/00	685.8				0			0		0	722.2	-36.4
101/10-03-039-24W3/00	690.1				0			0		0	727.9	-37.8
101/16-06-039-24W3/00	691.3				0			0		0	745.6	-54.3
131/10-08-039-24W3/00	688.5				0			0		0	737.8	-49.3
131/09-09-039-24W3/00	686.4				0			0		0	719.6	-33.2
111/02-10-039-24W3/00	686.3				0			0		0	724.5	-38.2
121/10-10-039-24W3/00	685.3				0			0		0	721.6	-36.3
141/16-11-039-24W3/00	685.8				0			0		0	722.3	-36.5
141/01-13-039-24W3/00	677.5				0			0		0	712.6	-35.1
121/16-13-039-24W3/00	678.6				0			0		0	713.0	-34.4
141/05-15-039-24W3/00	682.9				0			0		0	716.8	-33.9
141/07-15-039-24W3/00	682.8				0			0		0	717.0	-34.2
141/01-17-039-24W3/00	685.0				0			0		0	721.8	-36.8
111/03-18-039-24W3/00	680.2				0			0		0	741.7	-61.5
111/05-18-039-24W3/00	680.0				0			0		0	750.2	-70.2
111/11-18-039-24W3/00	672.5				0			0		0	735.0	-62.5
141/11-18-039-24W3/00	675.4				0			0		0	732.5	-57.1
191/12-18-039-24W3/00	672.5				0			0		0	741.7	-69.2
192/12-18-039-24W3/00	674.4				0			0		0	740.3	-65.9
191/13-18-039-24W3/00	672.7				0			0		0	737.5	-64.8
191/14-18-039-24W3/00	672.4				0			0		0	739.6	-67.2
111/15-18-039-24W3/00	674.2				0			0		0	725.3	-51.1
111/16-18-039-24W3/00	677.2				0			0		0	726.0	-48.8
111/02-19-039-24W3/00	674.5				0			0		0	729.7	-55.2
121/02-19-039-24W3/00	673.6				0			0		0	729.8	-56.2
111/03-19-039-24W3/00	671.8				0			0		0	732.4	-60.6
121/03-19-039-24W3/00	671.4				0			0		0	732.2	-60.8
111/04-19-039-24W3/00	674.2				0			0		0	738.6	-64.4
121/04-19-039-24W3/00	674.3				0			0		0	739.5	-65.2
111/05-19-039-24W3/00	670.0				0			0		0	739.9	-69.9
111/06-19-039-24W3/00	670.3				0			0		0	730.0	-59.7
111/07-19-039-24W3/00	672.1				0			0		0	724.8	-52.7
111/09-19-039-24W3/00	676.6				0			0		0	723.3	-46.7
121/09-19-039-24W3/00	672.6				0			0		0	717.8	-45.2
111/10-19-039-24W3/00	670.3				0			0		0	720.8	-50.5
121/10-19-039-24W3/00	672.3				0			0		0	721.8	-49.5
111/11-19-039-24W3/00	670.0				0			0		0	727.2	-57.2
121/11-19-039-24W3/00	671.9				0			0		0	724.6	-52.7
111/12-19-039-24W3/00	670.6				0			0		0	738.5	-67.9
121/12-19-039-24W3/00	677.5				0			0		0	746.2	-68.7
111/13-19-039-24W3/00	668.9				0			0		0	734.9	-66.0
111/14-19-039-24W3/00	669.0				0			0		0	720.5	-51.5
111/15-19-039-24W3/00	669.0				0			0		0	719.9	-50.9
111/16-19-039-24W3/00	672.9				0			0		0	715.8	-42.9
131/12-20-039-24W3/00	675.2				0			0		0	716.3	-41.1
121/13-20-039-24W3/00	674.4				0			0		0	718.0	-43.6
131/14-20-039-24W3/00	678.5				0			0		0	719.7	-41.2
141/14-20-039-24W3/00	679.5				0			0		0	720.4	-40.9
101/07-21-039-24W3/00	682.0				0			0		0	714.9	-32.9
111/16-21-039-24W3/00	685.5				0			0		0	717.0	-31.5
101/10-22-039-24W3/00	681.2				0			0		0	716.0	-34.8
111/14-22-039-24W3/00	683.6				0			0		0	721.2	-37.6
191/13-23-039-24W3/00	681.0				0			0		0	717.1	-36.1
111/05-25-039-24W3/00	678.6				0			0		0	724.3	-45.7
111/12-25-039-24W3/00	677.7				0			0		0	728.5	-50.8
111/13-25-039-24W3/00	678.6				0			0		0	731.0	-52.4
141/07-26-039-24W3/00	670.6				0			0		0	719.6	-49.0
111/09-26-039-24W3/00	678.6				0			0		0	727.6	-49.0
111/10-26-039-24W3/00	676.7				0			0		0	727.7	-51.0
112/10-26-039-24W3/00	675.3				0			0		0	725.8	-50.5
101/06-27-039-24W3/00	677.6				0			0		0	727.5	-49.9
111/15-27-039-24W3/00	665.3				0			0		0	724.7	-59.4
101/08-28-039-24W3/00	682.4				0			0		0	730.7	-48.3
121/09-28-039-24W3/00	680.0				0			0		0	731.9	-51.9
101/10-28-039-24W3/00	685.2				0			0		0	736.2	-51.0
111/10-28-039-24W3/00	686.3				0			0		0	735.9	-49.6
111/02-29-039-24W3/00	683.7				0			0		0	725.9	-42.2
121/04-29-039-24W3/00	676.8				0			0		0	724.3	-47.5
111/06-29-039-24W3/00	679.7				0			0		0	730.8	-51.1
111/07-29-039-24W3/00	684.1				0			0		0	726.4	-42.3
111/01-30-039-24W3/00	672.5				0			0		0	724.9	-52.4
111/02-30-039-24W3/00	670.7				0			0		0	721.4	-50.7
111/16-30-039-24W3/00	676.4				0			0		0	733.6	-57.2
111/02-32-039-24W3/00	681.6				0			0		0	736.5	-54.9
131/16-32-039-24W3/00	679.1				0			0		0	751.5	-72.4

Well I.D.	KB (m)	B. Valley TVD (m)	B. Valley SS (m)	F1Low. TVD (m)	F1Low. ISO (m)	Mid. Bkn TVD (m)	F1 Up. TVD (m)	F1 Up. ISO (m)	Miss. TVD (m)	Miss. ISO (m)	SubMesU. TVD (m)	SubMesU. SS (m)
101/11-35-039-24W3/00	674.8				0			0		0	734.0	-59.2
101/10-32-025-25W3/00	727.6	995.8	-268.2	984.6	11.2	958.2	956.3	1.9	930.0	26.3	930.0	-202.4
101/06-16-027-25W3/00	777.5	1017.7	-240.2	1005.1	12.6	980.8		0	974.1	6.7	974.1	-196.6
111/10-18-028-25W3/00	757.9	1001.0	-243.1	992.0	9	974.7	967.2	7.5	937.4	29.8	937.4	-179.5
101/10-12-029-25W3/00	701.0	900.0	-199	886.9	13.1	875.6	870.0	5.6	855.5	14.5	855.5	-154.5
101/11-29-029-25W3/00	719.6	915.5	-195.9	906.9	8.6	898.7	898.0	0.7	871.1	26.9	871.1	-151.5
101/06-31-029-25W3/00	725.0	923.5	-198.5	910.1	13.4	896.0	895.5	0.5	881.0	14.5	881.0	-156.0
111/14-06-030-25W3/00	718.5					882.6	880.9	1.7	864.3	16.6	864.3	-145.8
141/10-34-030-25W3/00	691.3	848.2	-156.9	841.8	6.4	828.5	824.9	3.6	792.0	32.9	792.0	-100.7
111/14-35-030-25W3/00	682.2	828.0	-145.8	822.5	5.5	796.0		0	784.8	11.2	784.8	-102.6
131/01-11-031-25W3/00	677.3	824.5	-147.2	818.5	6	802.9	801.5	1.4	784.0	17.5	784.0	-106.7
111/06-14-031-25W3/00	701.4	808.6	-107.2	806.0	2.6	780.3		0	770.3	10	770.3	-68.9
101/12-22-031-25W3/00	713.6	850.6	-137	845.1	5.5	836.3	830.5	5.8	796.5	34	796.5	-82.9
131/01-27-031-25W3/00	704.7	829.8	-125.1	825.3	4.5	804.8		0	797.3	7.5	797.3	-92.6
101/05-27-031-25W3/00	715.1	847.8	-132.7	838.7	9.1	827.5	825.1	2.4	772.1	53	772.1	-57.0
111/01-32-031-25W3/00	714.8	857.0	-142.2	851.8	5.2	840.2	838.5	1.7	832.0	6.5	832.0	-117.2
131/03-01-032-25W3/00	698.9								776.0		776.0	-77.1
111/06-04-032-25W3/00	702.1	829.0	-126.9	824.8	4.2	807.1		0	785.0	22.1	785.0	-82.9
111/07-11-032-25W3/00	698.8	819.0	-120.2	817.5	1.5	811.0	808.0	3	792.0	16	792.0	-93.2
101/05-14-032-25W3/00	696.8	848.0	-151.2	840.3	7.7	824.5		0	803.0	21.5	803.0	-106.2
131/11-14-032-25W3/00	701.1	820.0	-118.9	816.5	3.5	800.0	797.5	2.5	766.5	31	766.5	-65.4
121/11-25-032-25W3/00	717.2	823.0	-105.8	818.7	4.3	811.8	807.9	3.9	756.8	51.1	756.8	-39.6
141/04-35-032-25W3/00	710.7	820.2	-109.5	815.1	5.1	800.1	798.2	1.9	764.0	34.2	764.0	-53.3
131/02-36-032-25W3/00	734.4	843.2	-108.8	838.9	4.3	827.0		0	784.0	43	784.0	-49.6
121/02-01-033-25W3/00	722.9	828.9	-106	825.2	3.7	813.7	811.0	2.7		0	811.0	-88.1
101/15-07-033-25W3/00	719.0	859.6	-140.6	854.0	5.6	848.0		0		0	848.0	-129.0
101/12-15-033-25W3/00	722.2	808.4	-86.2	804.6	3.8	801.0	796.3	4.7	780.6	15.7	780.6	-58.4
101/07-24-033-25W3/00	709.3	797.4	-88.1	793.7	3.7	783.2	780.0	3.2	760.0	20	760.0	-50.7
101/13-24-033-25W3/00	709.3	795.8	-86.5	792.4	3.4	785.6	780.3	5.3	774.2	6.1	774.2	-64.9
101/16-29-033-25W3/00	729.7	863.1	-133.4	859.0	4.1	848.0	845.1	2.9		0	845.1	-115.4
111/10-31-033-25W3/00	722.9	842.9	-120	840.9	2			0		0	840.9	-118.0
141/05-32-033-25W3/00	730.6					839.8	837.5	2.3		0	837.5	-106.9
111/05-33-033-25W3/00	729.0	843.8	-114.8	840.1	3.7	830.3	828.8	1.5		0	828.8	-99.8
141/04-02-034-25W3/00	716.9	839.7	-122.8	837.2	2.5	823.6		0		0	823.6	-106.7
101/12-18-034-25W3/00	727.6	824.1	-96.5	820.6	3.5	800.9		0	782.0	18.9	782.0	-54.4
141/13-19-034-25W3/00	744.0	862.9	-118.9	860.6	2.3	840.0		0	795.0	45	795.0	-51.0
101/02-24-034-25W3/00	703.5	810.6	-107.1	807.8	2.8	798.1		0	769.3	28.8	769.3	-65.8
101/10-24-034-25W3/00	695.0	868.2	-173.2	864.5	3.7	851.0		0		0	851.0	-156.0
111/12-27-034-25W3/00	710.0	808.4	-98.4	803.5	4.9	786.8		0		0	786.8	-76.8
101/03-30-034-25W3/00	741.9	840.7	-98.8	837.6	3.1	827.3		0		0	827.3	-85.4
111/03-33-034-25W3/00	718.7	816.7	-98	814.1	2.6	792.7	791.1	1.6	783.6	7.5	783.6	-64.9
101/04-34-034-25W3/00	698.0	798.6	-100.6	795.5	3.1	783.3		0		0	783.3	-85.3
101/13-02-035-25W3/00	710.8	797.0	-86.2	794.2	2.8	791.0		0		0	791.0	-80.2
111/08-03-035-25W3/00	704.7	803.5	-98.8	800.3	3.2	784.6	781.9	2.7		0	781.9	-77.2
121/04-09-035-25W3/00	721.2	800.5	-79.3	797.0	3.5	778.3	775.5	2.8	773.2	2.3	773.2	-52.0
121/01-14-035-25W3/00	699.8	781.9	-82.1	778.8	3.1	771.6		0		0	771.6	-71.8
101/08-21-035-25W3/00	704.1	772.4	-68.3	770.2	2.2	753.0		0		0	753.0	-48.9
161/04-28-035-25W3/00	702.0	769.1	-67.1	766.1	3	746.9		0		0	746.9	-44.9
101/08-29-035-25W3/00	696.8	760.2	-63.4	757.2	3	739.7		0		0	739.7	-42.9
101/11-32-035-25W3/00	694.9	752.2	-57.3	748.7	3.5	737.6	733.0	4.6	725.2	7.8	725.2	-30.3
141/04-33-035-25W3/00	693.4			787.4	3.5	782.0		0	768.1	13.9	768.1	-74.7
101/10-06-036-25W3/00	693.7	757.1	-63.4	754.3	2.8	733.6	731.1	2.5		0	731.1	-37.4
111/07-07-036-25W3/00	695.6	744.8	-49.2	742.0	2.8	724.6	721.1	3.5		0	721.1	-25.5
101/13-07-036-25W3/00	690.4	741.2	-50.8	738.4	2.8	721.9	718.4	3.5		0	718.4	-28.0
101/14-07-036-25W3/00	692.5	743.6	-51.1	739.1	4.5	722.3	720.4	1.9	712.9	7.5	712.9	-20.4
101/16-07-036-25W3/00	694.9	755.9	-61	753.1	2.8	738.6	732.5	6.1		0	732.5	-37.6
101/14-08-036-25W3/00	701.6	748.2	-46.6	744.8	3.4	726.9	723.5	3.4	717.0	6.5	717.0	-15.4
111/05-09-036-25W3/00	709.0	761.8	-52.8	758.8	3	749.7	745.1	4.6		0	745.1	-36.1
101/11-09-036-25W3/00	708.1	780.5	-72.4	778.5	2	757.9	755.7	2.2		0	755.7	-47.6
101/04-10-036-25W3/00	710.8	767.3	-56.5		0			0		0	767.3	-56.5
101/01-17-036-25W3/00	699.5	750.0	-50.5	747.9	2.1	739.7	738.1	1.6		0	738.1	-38.6
111/06-17-036-25W3/00	690.7	758.5	-67.8	751.5	7	735.1	730.9	4.2		0	730.9	-40.2
101/12-17-036-25W3/00	684.3	735.3	-51	731.5	3.8	715.1	712.2	2.9		0	712.2	-27.9
141/03-18-036-25W3/00	692.6	741.1	-48.5	738.6	2.5	724.0		0		0	724.0	-31.4
101/04-20-036-25W3/00	685.2	731.6	-46.4	730.0	1.6	717.0	715.4	1.6		0	715.4	-30.2
141/12-23-036-25W3/00	732.6	771.9	-39.3	770.0	1.9	765.0		0		0	765.0	-32.4
161/04-29-036-25W3/00	684.9	766.0	-81.1	764.6	1.4	749.7	746.5	3.2		0	746.5	-61.6
101/06-30-036-25W3/00	683.4	748.2	-64.8	744.5	3.7	727.6		0		0	727.6	-44.2
131/08-30-036-25W3/00	687.8	743.4	-55.6	740.3	3.1	727.7	726.5	1.2		0	726.5	-38.7
121/11-32-036-25W3/00	688.3	734.2	-45.9	732.0	2.2	729.2		0		0	729.2	-40.9
121/10-33-036-25W3/00	712.3	755.6	-43.3		0			0		0	755.6	-43.3
191/12-33-036-25W3/00	707.4	745.0	-37.6		0			0		0	745.0	-37.6
111/16-35-036-25W3/00	700.6	752.1	-51.5		0			0		0	752.1	-51.5
101/16-36-036-25W3/00	700.7	742.1	-41.4		0			0		0	742.1	-41.4
131/07-01-037-25W3/00	695.1				0			0		0	740.6	-45.5
111/11-02-037-25W3/00	691.5				0			0		0	744.9	-53.4
131/01-04-037-25W3/00	701.1				0			0		0	753.8	-52.7
101/13-04-037-25W3/00	698.3				0			0		0	756.0	-57.7

Well I.D.	KB (m)	B. Valley TVD (m)	B. Valley SS (m)	F1Low. TVD (m)	F1Low. ISO (m)	Mid. Bkn TVD (m)	F1 Up. TVD (m)	F1 Up. ISO (m)	Miss. TVD (m)	Miss. ISO (m)	SubMesU. TVD (m)	SubMesU. SS (m)
141/03-05-037-25W3/00	693.1				0			0		0	749.0	-55.9
121/10-07-037-25W3/00	702.0				0			0		0	766.6	-64.6
141/08-11-037-25W3/00	696.5				0			0		0	760.6	-64.1
111/15-12-037-25W3/00	692.2				0			0		0	739.1	-46.9
141/06-17-037-25W3/00	696.5				0			0		0	763.7	-67.2
101/09-21-037-25W3/00	698.6				0			0		0	761.3	-62.7
101/11-23-037-25W3/00	682.1				0			0		0	757.0	-74.9
111/05-33-037-25W3/00	708.2				0			0		0	770.7	-62.5
101/10-33-037-25W3/00	709.5				0			0		0	765.7	-56.2
102/10-33-037-25W3/00	709.0				0			0		0	764.0	-55.0
111/11-33-037-25W3/00	709.7				0			0		0	767.4	-57.7
111/15-33-037-25W3/00	710.1				0			0		0	764.8	-54.7
141/11-34-037-25W3/00	708.6				0			0		0	764.7	-56.1
111/07-02-038-25W3/00	703.1				0			0		0	752.2	-49.1
111/08-03-038-25W3/00	710.9				0			0		0	769.8	-58.9
131/06-08-038-25W3/00	727.9				0			0		0	773.9	-46.0
111/05-11-038-25W3/00	703.8				0			0		0	751.9	-48.1
111/05-20-038-25W3/00	720.3				0			0		0	769.0	-48.7
101/16-22-038-25W3/00	693.1				0			0		0	737.6	-44.5
101/10-24-038-25W3/00	696.8				0			0		0	743.1	-46.3
101/09-25-038-25W3/00	699.0				0			0		0	742.0	-43.0
121/11-26-038-25W3/00	692.5				0			0		0	734.0	-41.5
111/10-27-038-25W3/00	695.3				0			0		0	738.0	-42.7
101/11-29-038-25W3/00	707.7				0			0		0	755.9	-48.2
131/13-32-038-25W3/00	712.3	787.2	-74.9		0			0		0	787.2	-74.9
121/03-35-038-25W3/00	698.3				0			0		0	743.1	-44.8
101/01-01-039-25W3/00	690.4				0			0		0	745.6	-55.2
131/10-01-039-25W3/00	684.4				0			0		0	728.8	-44.4
101/02-02-039-25W3/00	687.3				0			0		0	736.5	-49.2
111/16-02-039-25W3/00	687.2				0			0		0	741.7	-54.5
101/10-03-039-25W3/00	691.3				0			0		0	739.3	-48.0
131/11-03-039-25W3/00	686.8				0			0		0	729.4	-42.6
131/07-04-039-25W3/00	707.7				0			0		0	760.4	-52.7
101/10-07-039-25W3/00	662.9				0			0		0	718.0	-55.1
121/11-07-039-25W3/00	659.4				0			0		0	704.0	-44.6
101/05-08-039-25W3/00	668.4				0			0		0	728.9	-60.5
121/06-08-039-25W3/00	673.2				0			0		0	737.5	-64.3
111/16-08-039-25W3/00	681.6				0			0		0	756.9	-75.3
101/14-09-039-25W3/00	688.5				0			0		0	744.1	-55.6
111/10-10-039-25W3/00	673.2				0			0		0	717.4	-44.2
101/11-10-039-25W3/00	677.6				0			0		0	717.7	-40.1
101/09-12-039-25W3/00	677.6				0			0		0	753.2	-75.6
121/02-13-039-25W3/00	677.6				0			0		0	753.6	-76.0
111/03-13-039-25W3/00	675.1				0			0		0	748.0	-72.9
111/05-13-039-25W3/00	668.6				0			0		0	745.3	-76.7
111/06-13-039-25W3/00	673.4				0			0		0	756.3	-82.9
111/07-13-039-25W3/00	676.2				0			0		0	750.2	-74.0
111/08-13-039-25W3/00	676.3				0			0		0	746.1	-69.8
111/09-13-039-25W3/00	673.0				0			0		0	744.6	-71.6
191/09-13-039-25W3/00	675.2				0			0		0	747.0	-71.8
111/10-13-039-25W3/00	673.3				0			0		0	747.7	-74.4
111/11-13-039-25W3/00	672.1				0			0		0	751.5	-79.4
111/12-13-039-25W3/00	669.6				0			0		0	747.3	-77.7
111/13-13-039-25W3/00	670.3				0			0		0	749.6	-79.3
121/13-13-039-25W3/00	671.8				0			0		0	749.8	-78.0
131/13-13-039-25W3/00	670.1				0			0		0	749.9	-79.8
111/14-13-039-25W3/00	671.5				0			0		0	748.2	-76.7
121/14-13-039-25W3/00	670.0				0			0		0	753.2	-83.2
111/15-13-039-25W3/00	671.2				0			0		0	743.9	-72.7
141/15-13-039-25W3/00	670.7				0			0		0	743.0	-72.3
111/16-13-039-25W3/00	671.2				0			0		0	744.0	-72.8
111/02-14-039-25W3/00	685.4				0			0		0	758.0	-72.6
191/02-14-039-25W3/00	676.6				0			0		0	741.5	-64.9
111/04-14-039-25W3/00	661.9				0			0		0	731.5	-69.6
191/05-14-039-25W3/00	657.7				0			0		0	733.2	-75.5
192/05-14-039-25W3/00	653.9				0			0		0	717.6	-63.7
111/06-14-039-25W3/00	660.4				0			0		0	729.6	-69.2
191/06-14-039-25W3/00	662.6				0			0		0	729.2	-66.6
111/07-14-039-25W3/00	674.9				0			0		0	745.9	-71.0
121/07-14-039-25W3/00	662.5				0			0		0	734.5	-72.0
101/08-14-039-25W3/00	673.4				0			0		0	742.5	-69.1
111/08-14-039-25W3/00	669.3				0			0		0	743.2	-73.9
111/09-14-039-25W3/00	671.2				0			0		0	746.7	-75.5
111/10-14-039-25W3/00	671.4				0			0		0	740.1	-68.7
191/11-14-039-25W3/00	654.9				0			0		0	724.5	-69.6
192/12-14-039-25W3/00	653.5				0			0		0	714.4	-60.9
191/13-14-039-25W3/00	651.6				0			0		0	716.7	-65.1
141/03-05-037-25W3/00	693.1				0			0		0	749.0	-55.9

Well I.D.	KB (m)	B. Valley TVD (m)	B. Valley SS (m)	F1Low. TVD (m)	F1Low. ISO (m)	Mid. Bkn TVD (m)	F1 Up. TVD (m)	F1 Up. ISO (m)	Miss. TVD (m)	Miss. ISO (m)	SubMesU. TVD (m)	SubMesU. SS (m)
192/14-14-039-25W3/00	655.6				0			0		0	716.8	-61.2
111/15-14-039-25W3/00	663.2				0			0		0	738.8	-75.6
121/15-14-039-25W3/00	659.1				0			0		0	729.2	-70.1
111/16-14-039-25W3/00	668.7				0			0		0	746.0	-77.3
121/16-14-039-25W3/00	671.9				0			0		0	744.8	-72.9
111/07-15-039-25W3/00	675.3				0			0		0	731.7	-56.4
111/08-15-039-25W3/00	660.8				0			0		0	727.8	-67.0
191/09-15-039-25W3/00	662.4				0			0		0	719.3	-56.9
191/10-15-039-25W3/00	662.7				0			0		0	716.4	-53.7
111/15-15-039-25W3/00	666.7				0			0		0	716.7	-50.0
111/16-15-039-25W3/00	656.8				0			0		0	719.4	-62.6
121/03-19-039-25W3/00	668.3				0			0		0	723.8	-55.5
131/11-19-039-25W3/00	675.4				0			0		0	724.9	-49.5
111/09-20-039-25W3/00	670.3				0			0		0	751.8	-81.5
131/14-20-039-25W3/00	661.7				0			0		0	738.5	-76.8
111/10-21-039-25W3/00	684.3				0			0		0	752.9	-68.6
131/12-21-039-25W3/00	679.7				0			0		0	749.7	-70.0
111/15-21-039-25W3/00	687.3				0			0		0	754.8	-67.5
111/06-22-039-25W3/00	666.9				0			0		0	714.5	-47.6
111/01-23-039-25W3/00	665.9				0			0		0	747.4	-81.5
111/02-23-039-25W3/00	657.6				0			0		0	735.6	-78.0
191/03-23-039-25W3/00	662.6				0			0		0	733.9	-71.3
191/04-23-039-25W3/00	665.7				0			0		0	734.3	-68.6
111/08-23-039-25W3/00	664.2				0			0		0	742.3	-78.1
111/16-23-039-25W3/00	664.8				0			0		0	746.1	-81.3
101/01-24-039-25W3/00	670.3				0			0		0	742.0	-71.7
111/01-24-039-25W3/00	673.0				0			0		0	737.2	-64.2
121/01-24-039-25W3/00	673.2				0			0		0	743.2	-70.0
101/02-24-039-25W3/00	669.0				0			0		0	742.4	-73.4
121/02-24-039-25W3/00	671.6				0			0		0	744.8	-73.2
111/03-24-039-25W3/00	668.1				0			0		0	746.4	-78.3
111/04-24-039-25W3/00	669.6				0			0		0	753.1	-83.5
101/06-24-039-25W3/00	665.7				0			0		0	741.4	-75.7
121/06-24-039-25W3/00	669.1				0			0		0	746.1	-77.0
101/07-24-039-25W3/00	669.3				0			0		0	740.3	-71.0
101/08-24-039-25W3/00	669.3				0			0		0	744.0	-74.7
111/09-24-039-25W3/00	668.7				0			0		0	737.6	-68.9
111/10-24-039-25W3/00	668.4				0			0		0	739.8	-71.4
111/15-24-039-25W3/00	667.8				0			0		0	741.7	-73.9
111/07-25-039-25W3/00	668.1				0			0		0	740.0	-71.9
121/11-27-039-25W3/00	674.2				0			0		0	750.0	-75.8
111/01-28-039-25W3/00	687.2				0			0		0	755.3	-68.1
111/13-28-039-25W3/00	676.8				0			0		0	753.0	-76.2
111/11-29-039-25W3/00	673.7				0			0		0	743.9	-70.2
111/13-30-039-25W3/00	672.3				0			0		0	717.9	-45.6
121/06-31-039-25W3/00	673.1				0			0		0	723.8	-50.7
111/05-33-039-25W3/00	664.6				0			0		0	742.1	-77.5
111/10-34-039-25W3/00	662.0				0			0		0	753.0	-91.0
141/04-36-039-25W3/00	664.9				0			0		0	741.3	-76.4
101/04-06-025-26W3/00	693.4	976.3	-282.9	971.1	5.2	954.7	949.2	5.5	901.8	47.4	901.8	-208.4
101/07-11-027-26W3/00	740.7	976.0	-235.3	964.6	11.4	942.3		0	922.3	20	922.3	-181.6
101/06-30-027-26W3/00	713.3	960.1	-246.8	949.9	10.2	922.3		0	882.0	40.3	882.0	-168.7
101/11-11-028-26W3/00	727.9	954.0	-226.1	944.9	9.1	919.0	917.0	2	905.3	11.7	905.3	-177.4
141/04-05-029-26W3/00	763.6	964.2	-200.6	960.4	3.8	941.3		0	907.6	33.7	907.6	-144.0
101/08-10-029-26W3/00	752.2			945.5		923.6	922.0	1.6	902.2	19.8	902.2	-150.0
101/04-22-029-26W3/00	745.8	939.3	-193.5	933.8	5.5	913.7	911.2	2.5	879.7	31.5	879.7	-133.9
101/09-29-029-26W3/00	718.4	921.6	-203.2	917.1	4.5	893.6	890.7	2.9	873.8	16.9	873.8	-155.4
101/10-31-029-26W3/00	717.5	930.0	-212.5	925.5	4.5	907.7	905.2	2.5	872.9	32.3	872.9	-155.4
131/05-13-030-26W3/00	721.6				0			0		0	957.0	-235.4
101/11-16-030-26W3/00	720.9	895.2	-174.3	889.7	5.5	874.7	868.7	6		0	868.7	-147.8
101/11-17-030-26W3/00	708.7	893.4	-184.7	888.7	4.7	871.7	868.6	3.1	827.2	41.4	827.2	-118.5
101/10-18-030-26W3/00	698.3			907.3	6.2	894.3	888.1	6.2	855.8	32.3	855.8	-157.5
101/06-19-030-26W3/00	702.6	902.0	-199.4	897.6	4.4	889.4	886.4	3	876.6	9.8	876.6	-174.0
101/11-22-030-26W3/00	723.9	889.8	-165.9	884.7	5.1	872.0	870.7	1.3	853.4	17.3	853.4	-129.5
111/01-26-030-26W3/00	735.8	907.0	-171.2	901.3	5.7	875.2	870.3	4.9		0	870.3	-134.5
111/14-02-031-26W3/00	720.3	879.8	-159.5	874.8	5	860.9		0	843.8	17.1	843.8	-123.5
101/10-06-031-26W3/00	719.3	876.1	-156.8	872.7	3.4	853.3	852.8	0.5	841.9	10.9	841.9	-122.6
121/02-07-031-26W3/00	726.9	903.6	-176.7	899.8	3.8	884.7	882.8	1.9	871.7	11.1	871.7	-144.8
121/03-07-031-26W3/00	738.9	903.7	-164.8	899.6	4.1	884.6	883.0	1.6	873.0	10	873.0	-134.1
191/14-10-031-26W3/00	696.1	856.0	-159.9	851.5	4.5	839.5	838.0	1.5	817.2	20.8	817.2	-121.1
121/04-12-031-26W3/00	724.5	879.0	-154.5	874.6	4.4	863.0		0		0	863.0	-138.5
121/08-17-031-26W3/00	721.5	914.0	-192.5	910.0	4	900.0	898.8	1.2	882.5	16.3	882.5	-161.0
101/16-21-031-26W3/00	716.9	857.7	-140.8	853.1	4.6	842.2	841.1	1.1	822.3	18.8	822.3	-105.4
101/08-22-031-26W3/00	710.5	858.2	-147.7	853.7	4.5	841.2	841.2	0	814.6	26.6	814.6	-104.1
122/02-23-031-26W3/00	712.6								805.9		805.9	-93.3
111/06-23-031-26W3/00	711.9	852.1	-140.2	847.8	4.3	837.0		0	809.5	27.5	809.5	-97.6
101/14-24-031-26W3/00	728.8	902.0	-173.2	898.0	4	890.5		0		0	890.5	-161.7
192/14-14-039-25W3/00	655.6				0			0		0	716.8	-61.2

Well I.D.	KB (m)	B. Valley TVD (m)	B. Valley SS (m)	F1Low. TVD (m)	F1Low. ISO (m)	Mid. Bkn TVD (m)	F1 Up. TVD (m)	F1 Up. ISO (m)	Miss. TVD (m)	Miss. ISO (m)	SubMesU. TVD (m)	SubMesU. SS (m)
101/05-27-031-26W3/00	722.1	865.5	-143.4	861.6	3.9	851.2		0		0	851.2	-129.1
101/10-29-031-26W3/00	709.6	856.4	-146.8	854.2	2.2	850.2		0		0	850.2	-140.6
101/07-30-031-26W3/00	708.1	876.6	-168.5	872.0	4.6	867.5	863.4	4.1	828.3	35.1	828.3	-120.2
101/11-36-031-26W3/00	725.1	903.6	-178.5		0			0	888.0	15.6	888.0	-162.9
111/06-07-032-26W3/00	704.9	869.7	-164.8	865.1	4.6	855.3		0	850.2	5.1	850.2	-145.3
101/11-20-032-26W3/00	725.4	861.9	-136.5	856.5	5.4	845.1	843.2	1.9		0	843.2	-117.8
111/13-35-032-26W3/00	727.7	874.0	-146.3	871.8	2.2	866.9		0		0	866.9	-139.2
101/10-04-033-26W3/00	727.6	869.4	-141.8	866.1	3.3			0		0	866.1	-138.5
111/01-06-033-26W3/00	721.5	901.8	-180.3	893.8	8	882.3	877.5	4.8		0	877.5	-156.0
101/06-06-033-26W3/00	729.1	871.9	-142.8		0			0		0	871.9	-142.8
101/07-07-033-26W3/00	724.8	864.1	-139.3		0			0		0	864.1	-139.3
121/01-09-033-26W3/00	728.6	862.4	-133.8	859.9	2.5	847.2	845.8	1.4		0	845.8	-117.2
101/07-09-033-26W3/00	724.8	846.7	-121.9	837.1	9.6	831.9	831.0	0.9		0	831.0	-106.2
111/11-11-033-26W3/00	713.6	861.7	-148.1	859.1	2.6			0		0	859.1	-145.5
131/11-25-033-26W3/00	726.9	855.3	-128.4	852.4	2.9	843.4	840.8	2.6		0	840.8	-113.9
111/14-25-033-26W3/00	725.9	851.5	-125.6	849.3	2.2	839.1	836.8	2.3		0	836.8	-110.9
141/02-27-033-26W3/00	725.4	830.8	-105.4	828.2	2.6			0		0	828.2	-102.8
101/16-08-034-26W3/00	747.7	859.0	-111.3	856.6	2.4	838.0		0	832.0	6	832.0	-84.3
111/11-13-034-26W3/00	730.9	832.6	-101.7	830.6	2	811.0	808.6	2.4	794.7	13.9	794.7	-63.8
101/16-22-034-26W3/00	737.3	837.6	-100.3	835.9	1.7	824.2		0	797.1	27.1	797.1	-59.8
111/16-25-034-26W3/00	739.6	842.7	-103.1	840.1	2.6	825.1	823.1	2	806.3	16.8	806.3	-66.7
121/06-26-034-26W3/00	747.7	843.1	-95.4	838.5	4.6	832.4	829.3	3.1		0	829.3	-81.6
141/14-28-034-26W3/00	750.3	856.6	-106.3	854.1	2.5	850.4		0	828.4	22	828.4	-78.1
111/06-31-034-26W3/00	734.3	835.3	-101	832.7	2.6	821.1		0		0	821.1	-86.8
111/08-01-035-26W3/00	741.0	835.3	-94.3	832.9	2.4	813.7	811.5	2.2	802.4	9.1	802.4	-61.4
111/01-05-035-26W3/00	728.1	827.8	-99.7	825.6	2.2			0		0	825.6	-97.5
141/04-05-035-26W3/00	734.9	834.3	-99.4	832.0	2.3	830.8		0		0	830.8	-95.9
111/11-05-035-26W3/00	729.3	842.2	-112.9	840.4	1.8	836.9		0		0	836.9	-107.6
112/11-05-035-26W3/00	729.3	828.4	-99.1	826.0	2.4	824.4		0		0	824.4	-95.1
141/11-05-035-26W3/00	726.9			807.5	1.4	802.4	801.4	1		0	801.4	-74.5
131/16-05-035-26W3/00	728.7	831.1	-102.4		0			0	825.9	5.2	825.9	-97.2
101/01-06-035-26W3/00	735.5	843.6	-108.1	841.3	2.3			0		0	841.3	-105.8
101/01-09-035-26W3/00	747.7	844.8	-97.1	841.7	3.1	835.0		0		0	835.0	-87.3
121/06-09-035-26W3/00	731.0	808.6	-77.6		0			0		0	808.6	-77.6
121/11-10-035-26W3/00	760.1	851.0	-90.9	848.3	2.7	842.3		0		0	842.3	-82.2
101/05-14-035-26W3/00	742.5	826.4	-83.9	824.0	2.4	820.6		0	794.1	26.5	794.1	-51.6
101/08-15-035-26W3/00	743.7	832.0	-88.3	827.0	5	811.8		0	796.3	15.5	796.3	-52.6
111/10-19-035-26W3/00	747.1	842.1	-95	839.3	2.8	817.8		0	815.0	2.8	815.0	-67.9
121/02-22-035-26W3/00	731.2	822.2	-91	818.0	4.2	809.5	804.5	5	789.5	15	789.5	-58.3
101/06-22-035-26W3/00	715.4	800.6	-85.2	798.8	1.8	795.3	790.5	4.8	766.8	23.7	766.8	-51.4
101/02-27-035-26W3/00	684.0	760.6	-76.6	758.3	2.3	741.8		0		0	741.8	-57.8
121/04-28-035-26W3/00	697.1	785.9	-88.8	783.9	2	764.7		0	749.8	14.9	749.8	-52.7
111/10-28-035-26W3/00	688.5	775.2	-86.7	772.4	2.8	751.1		0	730.9	20.2	730.9	-42.4
111/11-29-035-26W3/00	702.2	787.6	-85.4	783.9	3.7	782.0		0		0	782.0	-79.8
111/14-31-035-26W3/00	691.6	773.6	-82	771.0	2.6	766.5	763.7	2.8		0	763.7	-72.1
111/07-36-035-26W3/00	719.3	777.1	-57.8	773.8	3.3	770.7		0	765.1	5.6	765.1	-45.8
101/13-36-035-26W3/00	717.2	798.4	-81.2	793.9	4.5	775.4	773.2	2.2	762.0	11.2	762.0	-44.8
101/11-09-036-26W3/00	705.6	772.0	-66.4	769.1	2.9	765.1	761.9	3.2		0	761.9	-56.3
101/07-10-036-26W3/00	723.0	793.2	-70.2	790.1	3.1	782.1	780.3	1.8		0	780.3	-57.3
111/06-12-036-26W3/00	700.0	795.1	-95.1	785.9	9.2	779.1	775.5	3.6		0	775.5	-75.5
101/06-13-036-26W3/00	693.1	792.0	-98.9	789.8	2.2	780.2		0	767.4	12.8	767.4	-74.3
111/08-19-036-26W3/00	695.3	763.0	-67.7	762.1	0.9	751.6		0		0	751.6	-56.3
121/11-19-036-26W3/00	683.4	760.4	-77	756.5	3.9	741.5	739.8	1.7		0	739.8	-56.4
101/04-20-036-26W3/00	698.3	776.9	-78.6	773.6	3.3	760.5	758.6	1.9	748.6	10	748.6	-50.3
101/16-20-036-26W3/00	700.1	771.2	-71.1	767.0	4.2	758.6	755.6	3		0	755.6	-55.5
101/06-25-036-26W3/00	685.2	743.4	-58.2	740.4	3	729.0	726.4	2.6		0	726.4	-41.2
131/02-28-036-26W3/00	702.4	775.5	-73.1	770.0	5.5	756.0	754.5	1.5		0	754.5	-52.1
101/03-28-036-26W3/00	700.6	780.0	-79.4	773.2	6.8	758.0	756.0	2		0	756.0	-55.4
111/04-28-036-26W3/00	702.2	776.5	-74.3	772.0	4.5	755.0		0		0	755.0	-52.8
121/05-28-036-26W3/00	699.6	769.0	-69.4	765.0	4	754.0		0		0	754.0	-54.4
101/05-29-036-26W3/00	698.3	774.4	-76.1	765.8	8.6	756.2	754.3	1.9		0	754.3	-56.0
101/06-29-036-26W3/00	700.7	781.1	-80.4	772.9	8.2	754.1		0		0	754.1	-53.4
101/12-32-036-26W3/00	702.9	779.3	-76.4		0			0		0	779.3	-76.4
161/13-01-037-26W3/00	696.5				0			0		0	775.0	-78.5
141/06-05-037-26W3/00	695.6				0			0		0	774.0	-78.4
111/07-05-037-26W3/00	693.9				0			0		0	765.8	-71.9
111/09-11-037-26W3/00	703.6				0			0		0	770.5	-66.9
121/08-15-037-26W3/00	707.5				0			0		0	776.3	-68.8
101/14-16-037-26W3/00	686.1				0			0		0	755.2	-69.1
101/10-21-037-26W3/00	697.8				0			0		0	767.3	-69.5
111/12-21-037-26W3/00	695.9				0			0		0	763.1	-67.2
111/12-22-037-26W3/00	698.8				0			0		0	763.1	-64.3
141/12-23-037-26W3/00	718.1				0			0		0	785.2	-67.1
101/06-24-037-26W3/00	690.4				0			0		0	754.0	-63.6
111/02-28-037-26W3/00	694.4				0			0		0	758.9	-64.5
111/04-28-037-26W3/00	698.7				0			0		0	766.3	-67.6
111/05-28-037-26W3/00	698.1				0			0		0	767.8	-69.7
111/08-29-037-26W3/00	700.2				0			0		0	768.3	-68.1

Well I.D.	KB (m)	B. Valley TVD (m)	B. Valley SS (m)	F1Low. TVD (m)	F1Low. ISO (m)	Mid. Bkn TVD (m)	F1 Up. TVD (m)	F1 Up. ISO (m)	Miss. TVD (m)	Miss. ISO (m)	SubMesU. TVD (m)	SubMesU. SS (m)
111/10-31-037-26W3/00	733.5				0			0		0	826.2	-92.7
111/14-31-037-26W3/00	729.6				0			0		0	827.2	-97.6
111/15-31-037-26W3/00	732.4				0			0		0	827.1	-94.7
111/16-31-037-26W3/00	734.7				0			0		0	827.5	-92.8
131/16-31-037-26W3/00	728.5				0			0		0	822.6	-94.1
111/13-32-037-26W3/00	727.2				0			0		0	823.2	-96.0
101/06-34-037-26W3/00	681.2				0			0		0	771.1	-89.9
101/05-10-038-26W3/00	694.3				0			0		0	792.7	-98.4
101/06-11-038-26W3/00	706.5				0			0		0	786.5	-80.0
111/16-15-038-26W3/00	698.9				0			0		0	787.6	-88.7
101/06-18-038-26W3/00	745.5				0			0		0	844.1	-98.6
101/16-22-038-26W3/00	699.8				0			0		0	833.5	-133.7
101/10-28-038-26W3/00	684.3				0			0		0	763.2	-78.9
111/07-30-038-26W3/00	721.8				0			0		0	829.8	-108.0
111/04-31-038-26W3/00	711.3				0			0		0	822.4	-111.1
101/11-31-038-26W3/00	712.9				0			0		0	816.9	-104.0
101/13-31-038-26W3/00	711.7				0			0		0	818.0	-106.3
101/14-31-038-26W3/00	708.0				0			0		0	812.0	-104.0
121/10-32-038-26W3/00	689.9				0			0		0	781.0	-91.1
111/12-32-038-26W3/00	699.5				0			0		0	795.4	-95.9
141/01-34-038-26W3/00	678.5				0			0		0	761.7	-83.2
111/09-34-038-26W3/00	685.6				0			0		0	762.1	-76.5
121/03-35-038-26W3/00	679.2				0			0		0	752.5	-73.3
191/01-01-039-26W3/00	681.4				0			0		0	740.3	-58.9
111/16-01-039-26W3/00	671.1				0			0		0	715.0	-43.9
121/05-02-039-26W3/00	679.8				0			0		0	750.0	-70.2
121/08-02-039-26W3/00	684.7				0			0		0	732.0	-47.3
101/05-03-039-26W3/00	685.8				0			0		0	770.0	-84.2
131/04-04-039-26W3/00	693.1				0			0		0	791.5	-98.4
111/05-04-039-26W3/00	690.4				0			0		0	789.5	-99.1
111/12-04-039-26W3/00	691.6				0			0		0	794.0	-102.4
111/13-04-039-26W3/00	688.8				0			0		0	791.5	-102.7
111/02-05-039-26W3/00	700.4				0			0		0	804.0	-103.6
111/03-05-039-26W3/00	708.4				0			0		0	815.0	-106.6
111/04-05-039-26W3/00	706.8				0			0		0	814.0	-107.2
101/05-05-039-26W3/00	698.3				0			0		0	804.0	-105.7
101/06-05-039-26W3/00	700.7				0			0		0	813.0	-112.3
131/06-05-039-26W3/00	696.7				0			0		0	805.0	-108.3
111/07-05-039-26W3/00	702.0				0			0		0	812.0	-110.0
111/08-05-039-26W3/00	695.9				0			0		0	800.5	-104.6
111/09-05-039-26W3/00	689.5				0			0		0	795.0	-105.5
111/10-05-039-26W3/00	695.6				0			0		0	805.5	-109.9
111/11-05-039-26W3/00	692.8				0			0		0	803.0	-110.2
141/11-05-039-26W3/00	689.0				0			0		0	794.5	-105.5
111/12-05-039-26W3/00	699.8				0			0		0	803.0	-103.2
111/13-05-039-26W3/00	694.0				0			0		0	799.5	-105.5
101/14-05-039-26W3/00	697.1				0			0		0	804.0	-106.9
111/15-05-039-26W3/00	692.8				0			0		0	799.0	-106.2
141/16-05-039-26W3/00	690.1				0			0		0	800.5	-110.4
111/01-06-039-26W3/00	705.9				0			0		0	816.0	-110.1
141/02-06-039-26W3/00	708.1				0			0		0	816.0	-107.9
101/03-06-039-26W3/00	707.4				0			0		0	809.0	-101.6
111/04-06-039-26W3/00	716.0				0			0		0	819.0	-103.0
121/05-06-039-26W3/00	711.7				0			0		0	812.0	-100.3
111/06-06-039-26W3/00	712.9				0			0		0	814.5	-101.6
111/07-06-039-26W3/00	702.9				0			0		0	813.0	-110.1
131/07-06-039-26W3/00	705.5				0			0		0	806.5	-101.0
121/08-06-039-26W3/00	700.4				0			0		0	807.0	-106.6
131/08-06-039-26W3/00	700.4				0			0		0	811.5	-111.1
111/09-06-039-26W3/00	703.5				0			0		0	809.0	-105.5
111/10-06-039-26W3/00	706.5				0			0		0	812.0	-105.5
131/10-06-039-26W3/00	706.2				0			0		0	808.5	-102.3
101/11-06-039-26W3/00	709.6				0			0		0	809.8	-100.2
111/12-06-039-26W3/00	714.5				0			0		0	805.0	-90.5
111/13-06-039-26W3/00	703.8				0			0		0	801.0	-97.2
111/15-06-039-26W3/00	707.1				0			0		0	809.5	-102.4
111/16-06-039-26W3/00	702.6				0			0		0	807.0	-104.4
111/01-07-039-26W3/00	700.1				0			0		0	802.5	-102.4
111/02-07-039-26W3/00	699.8				0			0		0	794.0	-94.2
111/03-07-039-26W3/00	701.3				0			0		0	790.0	-88.7
111/01-08-039-26W3/00	686.1				0			0		0	791.0	-104.9
111/02-08-039-26W3/00	690.4				0			0		0	799.0	-108.6
101/04-08-039-26W3/00	696.2				0			0		0	801.5	-105.3
111/07-08-039-26W3/00	695.2				0			0		0	798.0	-102.8
121/08-08-039-26W3/00	695.8				0			0		0	797.5	-101.7
111/04-09-039-26W3/00	682.1				0			0		0	785.5	-103.4
111/06-09-039-26W3/00	681.4				0			0		0	777.5	-96.1
111/07-09-039-26W3/00	682.5				0			0		0	781.5	-99.0

Well I.D.	KB (m)	B. Valley TVD (m)	B. Valley SS (m)	F1Low. TVD (m)	F1Low. ISO (m)	Mid. Bkn TVD (m)	F1 Up. TVD (m)	F1 Up. ISO (m)	Miss. TVD (m)	Miss. ISO (m)	SubMesU. TVD (m)	SubMesU. SS (m)
101/10-09-039-26W3/00	690.1				0			0		0	782.0	-91.9
111/13-09-039-26W3/00	689.8				0			0		0	789.0	-99.2
131/12-10-039-26W3/00	681.3				0			0		0	764.6	-83.3
191/10-11-039-26W3/00	660.0				0			0		0	734.4	-74.4
111/05-12-039-26W3/00	673.5				0			0		0	742.0	-68.5
101/04-13-039-26W3/00	659.2				0			0		0	727.0	-67.8
131/05-14-039-26W3/00	674.4				0			0		0	765.8	-91.4
111/08-16-039-26W3/00	673.2				0			0		0	774.0	-100.8
101/03-17-039-26W3/00	693.7				0			0		0	797.0	-103.3
111/06-19-039-26W3/00	683.5				0			0		0	781.5	-98.0
141/11-24-039-26W3/00	674.3				0			0		0	722.5	-48.2
101/13-24-039-26W3/00	673.9				0			0		0	724.0	-50.1
101/10-25-039-26W3/00	679.4				0			0		0	741.0	-61.6
111/07-27-039-26W3/00	684.0				0			0		0	767.8	-83.8
111/01-28-039-26W3/00	713.2				0			0		0	795.2	-82.0
141/07-28-039-26W3/00	709.8				0			0		0	795.5	-85.7
101/07-30-039-26W3/00	667.2				0			0		0	766.0	-98.8
131/13-30-039-26W3/00	673.5				0			0		0	773.5	-100.0
101/02-31-039-26W3/00	680.9				0			0		0	779.5	-98.6
121/03-31-039-26W3/00	679.3				0			0		0	779.0	-99.7
131/04-31-039-26W3/00	680.6				0			0		0	781.0	-100.4
141/05-31-039-26W3/00	681.8				0			0		0	782.5	-100.7
121/06-31-039-26W3/00	684.8				0			0		0	786.0	-101.2
102/09-31-039-26W3/00	685.8				0			0		0	787.0	-101.2
141/10-31-039-26W3/00	677.9				0			0		0	779.0	-101.1
111/11-31-039-26W3/00	669.5				0			0		0	774.0	-104.5
111/12-31-039-26W3/00	680.0				0			0		0	780.0	-100.0
141/12-31-039-26W3/00	678.6				0			0		0	779.5	-100.9
142/12-31-039-26W3/00	680.2				0			0		0	780.0	-99.8
101/14-31-039-26W3/00	672.4				0			0		0	774.0	-101.6
141/15-31-039-26W3/00	667.0				0			0		0	768.5	-101.5
111/16-31-039-26W3/00	676.5				0			0		0	779.0	-102.5
121/16-31-039-26W3/00	677.1				0			0		0	779.0	-101.9
131/04-32-039-26W3/00	681.9				0			0		0	783.5	-101.6
121/05-32-039-26W3/00	685.9				0			0		0	789.0	-103.1
131/05-32-039-26W3/00	686.5				0			0		0	779.0	-92.5
141/10-32-039-26W3/00	674.3				0			0		0	771.0	-96.7
121/11-32-039-26W3/00	681.0				0			0		0	770.0	-89.0
141/12-32-039-26W3/00	687.7				0			0		0	788.0	-100.3
131/13-32-039-26W3/00	668.9				0			0		0	768.0	-99.1
141/14-32-039-26W3/00	677.1				0			0		0	775.5	-98.4
111/11-33-039-26W3/00	677.7				0			0		0	764.0	-86.3
131/13-33-039-26W3/00	677.7				0			0		0	766.0	-88.3
131/14-33-039-26W3/00	672.2				0			0		0	760.0	-87.8
111/07-34-039-26W3/00	676.5				0			0		0	750.5	-74.0
102/07-35-039-26W3/00	676.0				0			0		0	722.0	-46.0
141/10-35-039-26W3/00	672.8				0			0		0	721.8	-49.0
121/07-36-039-26W3/00	677.3				0			0		0	724.5	-47.2
141/12-36-039-26W3/00	680.0				0			0		0	728.0	-48.0
101/06-12-025-27W3/00	693.1					932.0		0	927.5	4.5	927.5	-234.4
101/08-22-025-27W3/00	688.5	964.2	-275.7	953.4	10.8	931.2	926.8	4.4	923.3	3.5	923.3	-234.8
111/12-17-026-27W3/00	688.7								912.0		912.0	-223.3
101/01-05-027-27W3/00	695.2			945.4		916.5	913.8	2.7	883.9	29.9	883.9	-188.7
101/07-29-027-27W3/00	714.1	955.5	-241.4	945.7	9.8	916.8		0	913.8	3	913.8	-199.7
101/05-05-028-27W3/00	738.1	993.5	-255.4	985.5	8	965.0	961.4	3.6		0	961.4	-223.3
111/06-11-028-27W3/00	738.4	973.3	-234.9	964.5	8.8	944.8	939.9	4.9	935.1	4.8	935.1	-196.7
111/09-26-028-27W3/00	773.8	980.4	-206.6	977.2	3.2	948.5	940.2	8.3	921.8	18.4	921.8	-148.0
111/06-35-028-27W3/00	720.5	945.8	-225.3	943.5	2.3	915.4	910.4	5	889.8	20.6	889.8	-169.3
101/03-14-029-27W3/00	712.0					909.9	905.5	4.4	869.0	36.5	869.0	-157.0
101/06-25-029-27W3/00	701.0	914.0	-213	910.9	3.1	891.6	889.9	1.7	862.8	27.1	862.8	-161.8
101/16-27-029-27W3/00	729.4	948.6	-219.2	945.5	3.1	922.8	920.7	2.1	894.2	26.5	894.2	-164.8
111/12-04-030-27W3/00	714.7								838.8		838.8	-124.1
121/10-05-030-27W3/00	707.0	902.5	-195.5	899.6	2.9	874.5		0	817.0	57.5	817.0	-110.0
111/13-07-030-27W3/00	694.2	865.5	-171.3	862.5	3	836.3	835.5	0.8	781.0	54.5	781.0	-86.8
131/15-14-030-27W3/00	707.7	886.9	-179.2	883.1	3.8	861.0	859.0	2	852.5	6.5	852.5	-144.8
101/10-15-030-27W3/00	702.6	902.6	-200	897.6	5	878.7	875.7	3	867.5	8.2	867.5	-164.9
101/08-21-030-27W3/00	709.9	893.4	-183.5	889.9	3.5	880.4	876.6	3.8	865.8	10.8	865.8	-155.9
111/16-23-030-27W3/00	710.8	877.6	-166.8	873.4	4.2	856.8	854.5	2.3	848.7	5.8	848.7	-137.9
101/11-28-030-27W3/00	708.1	879.3	-171.2	876.6	2.7	858.6	856.8	1.8	847.0	9.8	847.0	-138.9
141/12-28-030-27W3/00	706.7	874.8	-168.1	870.1	4.7	855.0	852.8	2.2	843.5	9.3	843.5	-136.8
141/14-34-030-27W3/00	712.5	875.4	-162.9	872.0	3.4	856.3	854.9	1.4	847.1	7.8	847.1	-134.6
131/15-34-030-27W3/00	711.9	876.8	-164.9	873.7	3.1	860.7	858.0	2.7		0	850.9	-139.0
111/15-35-030-27W3/00	717.9	885.0	-167.1	880.0	5	872.0	870.3	1.7	849.8	20.5	849.8	-131.9
111/16-04-031-27W3/00	705.9	882.8	-176.9	879.0	3.8	859.0		0	848.4	10.6	848.4	-142.5
101/07-09-031-27W3/00	691.3	885.4	-194.1	882.2	3.2	867.0	863.5	3.5	849.2	14.3	849.2	-157.9
102/10-12-031-27W3/00	715.7	874.0	-158.3	869.7	4.3	850.2		0	835.6	14.6	835.6	-119.9
101/07-16-031-27W3/00	698.9	886.3	-187.4	883.3	3	863.9	861.1	2.8	840.9	20.2	840.9	-142.0
101/11-27-031-27W3/00	694.6	830.0	-135.4	825.5	4.5	820.6	816.0	4.6	806.4	9.6	806.4	-111.8

Well I.D.	KB (m)	B. Valley TVD (m)	B. Valley SS (m)	F1Low. TVD (m)	F1Low. ISO (m)	Mid. Bkn TVD (m)	F1 Up. TVD (m)	F1 Up. ISO (m)	Miss. TVD (m)	Miss. ISO (m)	SubMesU. TVD (m)	SubMesU. SS (m)
131/08-33-031-27W3/00	706.5	847.6	-141.1	843.8	3.8	824.1	822.6	1.5	810.0	12.6	810.0	-103.5
111/10-36-031-27W3/00	720.9	881.2	-160.3	876.8	4.4	868.0	865.3	2.7	851.5	13.8	851.5	-130.6
101/12-36-031-27W3/00	704.7	871.0	-166.3	867.1	3.9	863.2	860.0	3.2	818.5	41.5	818.5	-113.8
101/10-01-032-27W3/00	702.3	889.7	-187.4	887.4	2.3	877.6	874.8	2.8	849.2	25.6	849.2	-146.9
101/06-03-032-27W3/00	704.1	886.4	-182.3	884.4	2	868.6	866.0	2.6	841.4	24.6	841.4	-137.3
111/13-07-032-27W3/00	689.4	826.0	-136.6	821.3	4.7			0	808.4	12.9	808.4	-119.0
121/14-10-032-27W3/00	721.1	876.0	-154.9	874.0	2	863.5	859.9	3.6	834.3	25.6	834.3	-113.2
121/03-11-032-27W3/00	709.0	860.2	-151.2	855.2	5	838.8	835.5	3.3		0	835.5	-126.5
121/13-15-032-27W3/00	729.9	889.9	-160	884.0	5.9	870.4		0	842.1	28.3	842.1	-112.2
101/16-19-032-27W3/00	699.5	855.6	-156.1	854.4	1.2	846.8		0		0	846.8	-147.3
101/07-21-032-27W3/00	739.4	905.5	-166.1	902.3	3.2	893.8		0	884.1	9.7	884.1	-144.7
111/06-24-032-27W3/00	713.3	883.9	-170.6	882.1	1.8	874.5		0		0	874.5	-161.2
101/10-33-032-27W3/00	724.5	871.5	-147	868.2	3.3	865.6		0		0	865.6	-141.1
111/08-36-032-27W3/00	726.1	886.9	-160.8	883.6	3.3	876.3		0		0	876.3	-150.2
101/07-01-033-27W3/00	732.4	867.3	-134.9		0			0		0	867.3	-134.9
111/16-01-033-27W3/00	734.1	881.1	-147		0			0		0	881.1	-147.0
101/14-02-033-27W3/00	724.3				0			0		0	876.5	-152.2
101/06-08-033-27W3/00	714.8				0			0		0	870.8	-156.0
111/13-08-033-27W3/00	705.8	851.9	-146.1		0			0		0	851.9	-146.1
101/06-11-033-27W3/00	725.7	877.9	-152.2		0			0		0	877.9	-152.2
111/06-13-033-27W3/00	741.7	890.2	-148.5	888.1	2.1	881.0	878.6	2.4		0	878.6	-136.9
111/05-14-033-27W3/00	730.8	893.8	-163	885.6	8.2	879.9		0	873.4	6.5	873.4	-142.6
111/12-16-033-27W3/00	714.1			871.0	3.8	864.0	862.6	1.4	854.0	8.6	854.0	-139.9
111/06-18-033-27W3/00	715.0	869.8	-154.8	866.4	3.4	850.4	849.0	1.4		0	849.0	-134.0
111/11-18-033-27W3/00	714.7	861.3	-146.6	857.5	3.8	851.5	849.8	1.7		0	849.8	-135.1
101/16-18-033-27W3/00	710.5	882.0	-171.5	880.1	1.9	873.3	871.7	1.6	868.8	2.9	868.8	-158.3
111/11-19-033-27W3/00	727.3	906.4	-179.1	904.3	2.1	898.3	895.2	3.1	874.2	21	874.2	-146.9
101/05-20-033-27W3/00	701.6	845.0	-143.4	842.2	2.8	828.2		0		0	828.2	-126.6
121/12-20-033-27W3/00	695.9	843.3	-147.4	840.0	3.3	829.1	827.4	1.7		0	827.4	-131.5
111/09-22-033-27W3/00	727.9	871.3	-143.4	868.7	2.6	861.8	860.2	1.6		0	860.2	-132.3
111/12-31-033-27W3/00	734.6	865.5	-130.9	862.3	3.2	858.2	855.0	3.2		0	855.0	-120.4
111/10-32-033-27W3/00	727.3	860.7	-133.4	857.7	3			0		0	857.7	-130.4
141/15-32-033-27W3/00	724.5	847.3	-122.8	844.5	2.8	839.8		0		0	839.8	-115.3
101/10-33-033-27W3/00	716.3			872.1	1.6	853.6		0		0	853.6	-137.3
131/16-03-034-27W3/00	731.0	861.5	-130.5		0			0		0	861.5	-130.5
131/05-09-034-27W3/00	702.8	817.1	-114.3	815.1	2	806.1	805.0	1.1		0	805.0	-102.2
101/07-11-034-27W3/00	724.2	847.5	-123.3		0			0		0	847.5	-123.3
101/12-17-034-27W3/00	735.7	854.8	-119.1	851.6	3.2	836.8	835.7	1.1		0	835.7	-100.0
111/01-29-034-27W3/00	708.0	830.8	-122.8		0			0		0	830.8	-122.8
141/05-34-034-27W3/00	712.9	815.8	-102.9	811.7	4.1	807.8	804.7	3.1		0	804.7	-91.8
101/15-34-034-27W3/00	718.4	827.4	-109	823.3	4.1	818.0	816.1	1.9		0	816.1	-97.7
121/16-03-035-27W3/00	713.8	812.0	-98.2	810.2	1.8			0		0	810.2	-96.4
101/15-08-035-27W3/00	741.0	830.6	-89.6	829.3	1.3			0		0	829.3	-88.3
111/02-15-035-27W3/00	716.2	817.8	-101.6	815.2	2.6	810.1		0	801.2	8.9	801.2	-85.0
141/03-15-035-27W3/00	721.8	825.0	-103.2	824.1	0.9			0	804.4	19.7	804.4	-82.6
111/06-15-035-27W3/00	723.5			850.0	1.5	846.4		0	842.0	4.4	842.0	-118.5
131/16-27-035-27W3/00	747.1	836.8	-89.7	834.4	2.4			0	827.1	7.3	827.1	-80.0
101/11-28-035-27W3/00	742.2	847.1	-104.9	843.0	4.1			0	836.0	7	836.0	-93.8
141/09-29-035-27W3/00	743.7	855.4	-111.7	850.9	4.5			0	842.3	8.6	842.3	-98.6
121/12-31-035-27W3/00	757.9	856.8	-98.9	853.9	2.9	833.8	833.8	0		0	833.8	-75.9
131/07-07-036-27W3/00	709.3	811.2	-101.9	808.6	2.6	797.0		0		0	797.0	-87.7
131/06-10-036-27W3/00	700.3	781.0	-80.7	777.4	3.6	772.8		0		0	772.8	-72.5
101/12-10-036-27W3/00	698.9	791.8	-92.9	787.9	3.9	767.6		0		0	767.6	-68.7
101/10-22-036-27W3/00	668.5	744.8	-76.3		0			0		0	744.8	-76.3
101/07-24-036-27W3/00	685.8	760.0	-74.2	756.9	3.1	739.3		0		0	739.3	-53.5
101/08-24-036-27W3/00	687.6	756.2	-68.6	752.8	3.4	743.7	740.1	3.6		0	740.1	-52.5
101/13-25-036-27W3/00	691.6	763.3	-71.7	759.2	4.1	752.4		0		0	752.4	-60.8
111/13-31-036-27W3/00	685.4	763.5	-78.1	756.2	7.3	740.0		0		0	740.0	-54.6
161/04-36-036-27W3/00	690.1	761.5	-71.4	757.8	3.7	746.7		0		0	746.7	-56.6
121/10-03-037-27W3/00	732.9				0			0		0	817.5	-84.6
161/13-06-037-27W3/00	721.2				0			0		0	802.0	-80.8
111/05-13-037-27W3/00	736.4				0			0		0	832.5	-96.1
131/10-19-037-27W3/00	733.9				0			0		0	805.5	-71.6
121/11-21-037-27W3/00	744.6				0			0		0	818.9	-74.3
101/15-21-037-27W3/00	751.3				0			0		0	829.1	-77.8
131/15-22-037-27W3/00	762.3				0			0		0	851.0	-88.7
121/10-24-037-27W3/00	748.3				0			0		0	843.1	-94.8
141/07-27-037-27W3/00	765.0				0			0		0	847.9	-82.9
101/13-29-037-27W3/00	730.9				0			0		0	833.0	-102.1
141/16-29-037-27W3/00	721.1				0			0		0	827.5	-106.4
121/11-30-037-27W3/00	735.5				0			0		0	816.2	-80.7
111/09-32-037-27W3/00	708.1				0			0		0	809.0	-100.9
101/10-32-037-27W3/00	704.4				0			0		0	807.1	-102.7
141/16-05-038-27W3/00	686.3				0			0		0	789.4	-103.1
111/08-10-038-27W3/00	711.5				0			0		0	825.1	-113.6
111/11-10-038-27W3/00	700.4				0			0		0	806.8	-106.4
111/10-11-038-27W3/00	732.5				0			0		0	837.1	-104.6
121/04-13-038-27W3/00	746.2				0			0		0	843.6	-97.4

Well I.D.	KB (m)	B. Valley TVD (m)	B. Valley SS (m)	F1Low. TVD (m)	F1Low. ISO (m)	Mid. Bkn TVD (m)	F1 Up. TVD (m)	F1 Up. ISO (m)	Miss. TVD (m)	Miss. ISO (m)	SubMesU. TVD (m)	SubMesU. SS (m)
191/01-14-038-27W3/00	746.4				0			0		0	842.8	-96.4
111/03-15-038-27W3/00	711.4				0			0		0	812.7	-101.3
121/04-15-038-27W3/00	696.2				0			0		0	791.0	-94.8
131/07-16-038-27W3/00	688.6				0			0		0	783.0	-94.4
121/16-17-038-27W3/00	676.9				0			0		0	770.9	-94.0
131/06-19-038-27W3/00	688.1				0			0		0	769.8	-81.7
101/07-19-038-27W3/00	690.1				0			0		0	767.5	-77.4
131/07-19-038-27W3/00	691.0				0			0		0	777.0	-86.0
141/06-20-038-27W3/00	686.1				0			0		0	771.5	-85.4
131/11-21-038-27W3/00	688.5				0			0		0	781.8	-93.3
101/16-22-038-27W3/00	747.4				0			0		0	870.9	-123.5
111/13-25-038-27W3/00	716.6				0			0		0	825.6	-109.0
101/06-26-038-27W3/00	737.9				0			0		0	833.7	-95.8
121/07-29-038-27W3/00	685.6				0			0		0	770.9	-85.3
111/06-30-038-27W3/00	690.5				0			0		0	757.9	-67.4
141/11-31-038-27W3/00	688.5				0			0		0	760.5	-72.0
111/08-32-038-27W3/00	695.8				0			0		0	780.1	-84.3
121/08-32-038-27W3/00	694.9				0			0		0	779.2	-84.3
101/01-33-038-27W3/00	703.8				0			0		0	791.1	-87.3
111/15-33-038-27W3/00	703.8				0			0		0	787.8	-84.0
111/15-34-038-27W3/00	713.8				0			0		0	805.6	-91.8
111/16-34-038-27W3/00	717.2				0			0		0	808.8	-91.6
111/01-35-038-27W3/00	719.9				0			0		0	821.3	-101.4
131/05-35-038-27W3/00	719.6				0			0		0	809.8	-90.2
131/06-35-038-27W3/00	718.1				0			0		0	813.1	-95.0
111/07-35-038-27W3/00	718.1				0			0		0	809.3	-91.2
141/08-35-038-27W3/00	717.5				0			0		0	818.5	-101.0
111/09-35-038-27W3/00	718.1				0			0		0	817.8	-99.7
111/10-35-038-27W3/00	712.6				0			0		0	813.5	-100.9
111/11-35-038-27W3/00	717.5				0			0		0	818.2	-100.7
121/12-35-038-27W3/00	719.6				0			0		0	812.9	-93.3
101/13-35-038-27W3/00	710.5				0			0		0	804.1	-93.6
141/14-35-038-27W3/00	720.9				0			0		0	813.6	-92.7
111/15-35-038-27W3/00	718.1				0			0		0	813.2	-95.1
101/16-35-038-27W3/00	709.9				0			0		0	808.1	-98.2
111/05-36-038-27W3/00	705.9				0			0		0	809.2	-103.3
141/06-36-038-27W3/00	709.6				0			0		0	818.6	-109.0
111/09-36-038-27W3/00	719.5				0			0		0	825.3	-105.8
111/10-36-038-27W3/00	723.6				0			0		0	832.7	-109.1
101/11-36-038-27W3/00	717.8				0			0		0	826.1	-108.3
101/12-36-038-27W3/00	719.6				0			0		0	824.3	-104.7
111/13-36-038-27W3/00	710.5				0			0		0	814.1	-103.6
111/15-36-038-27W3/00	720.9				0			0		0	828.3	-107.4
111/16-36-038-27W3/00	713.8				0			0		0	821.5	-107.7
111/01-01-039-27W3/00	716.9				0			0		0	812.5	-95.6
111/02-01-039-27W3/00	715.7				0			0		0	813.0	-97.3
111/03-01-039-27W3/00	718.1				0			0		0	812.0	-93.9
111/04-01-039-27W3/00	714.5				0			0		0	807.0	-92.5
101/05-01-039-27W3/00	722.1				0			0		0	812.0	-89.9
141/06-01-039-27W3/00	716.9				0			0		0	807.5	-90.6
111/07-01-039-27W3/00	714.8				0			0		0	814.0	-99.2
111/08-01-039-27W3/00	709.9				0			0		0	808.0	-98.1
121/09-01-039-27W3/00	712.6				0			0		0	801.5	-88.9
121/10-01-039-27W3/00	708.1				0			0		0	795.5	-87.4
141/11-01-039-27W3/00	709.6				0			0		0	798.0	-88.4
111/12-01-039-27W3/00	713.5				0			0		0	803.0	-89.5
121/13-01-039-27W3/00	701.0				0			0		0	789.5	-88.5
111/14-01-039-27W3/00	705.0				0			0		0	794.5	-89.5
121/15-01-039-27W3/00	706.8				0			0		0	795.0	-88.2
101/16-01-039-27W3/00	709.6				0			0		0	802.0	-92.4
111/01-02-039-27W3/00	710.5				0			0		0	803.0	-92.5
111/02-02-039-27W3/00	715.1				0			0		0	805.0	-89.9
111/08-02-039-27W3/00	724.2				0			0		0	813.5	-89.3
111/16-02-039-27W3/00	705.0				0			0		0	792.5	-87.5
121/02-03-039-27W3/00	694.6				0			0		0	781.0	-86.4
111/05-03-039-27W3/00	687.8				0			0		0	748.5	-60.7
111/16-03-039-27W3/00	721.5				0			0		0	790.0	-68.5
131/04-04-039-27W3/00	692.7				0			0		0	756.0	-63.3
111/12-04-039-27W3/00	684.1				0			0		0	741.9	-57.8
131/10-05-039-27W3/00	686.2				0			0		0	743.0	-56.8
111/05-06-039-27W3/00	650.1				0			0		0	734.0	-83.9
111/07-06-039-27W3/00	672.1				0			0		0	739.0	-66.9
141/09-06-039-27W3/00	680.3				0			0		0	757.2	-76.9
121/10-06-039-27W3/00	676.2				0			0		0	757.5	-81.3
101/11-06-039-27W3/00	651.7				0			0		0	732.5	-80.8
111/12-06-039-27W3/00	644.0				0			0		0	725.5	-81.5
111/14-06-039-27W3/00	650.7				0			0		0	730.0	-79.3
131/16-07-039-27W3/00	653.5				0			0		0	744.5	-91.0

Well I.D.	KB (m)	B. Valley TVD (m)	B. Valley SS (m)	F1Low. TVD (m)	F1Low. ISO (m)	Mid. Bkn TVD (m)	F1 Up. TVD (m)	F1 Up. ISO (m)	Miss. TVD (m)	Miss. ISO (m)	SubMesU. TVD (m)	SubMesU. SS (m)
121/08-08-039-27W3/00	664.2				0			0		0	728.0	-63.8
121/04-09-039-27W3/00	670.8				0			0		0	726.5	-55.7
122/04-09-039-27W3/00	669.3				0			0		0	725.2	-55.9
101/04-10-039-27W3/00	703.5				0			0		0	770.5	-67.0
111/16-10-039-27W3/00	686.7				0			0		0	790.5	-103.8
111/08-11-039-27W3/00	697.4				0			0		0	788.0	-90.6
111/01-12-039-27W3/00	709.3				0			0		0	797.5	-88.2
101/06-12-039-27W3/00	709.0				0			0		0	797.0	-88.0
101/09-13-039-27W3/00	709.3				0			0		0	801.5	-92.2
101/10-13-039-27W3/00	709.3				0			0		0	803.5	-94.2
111/10-13-039-27W3/00	715.1				0			0		0	810.0	-94.9
111/11-13-039-27W3/00	703.5				0			0		0	799.5	-96.0
111/10-14-039-27W3/00	696.0				0			0		0	795.5	-99.5
111/04-15-039-27W3/00	677.6				0			0		0	775.5	-97.9
131/13-15-039-27W3/00	676.8				0			0		0	766.5	-89.7
111/07-16-039-27W3/00	670.7				0			0		0	768.7	-98.0
141/10-16-039-27W3/00	665.7				0			0		0	763.0	-97.3
111/13-16-039-27W3/00	664.1				0			0		0	760.5	-96.4
121/06-17-039-27W3/00	662.3				0			0		0	747.0	-84.7
131/08-17-039-27W3/00	664.5				0			0		0	740.0	-75.5
111/16-17-039-27W3/00	662.7				0			0		0	764.5	-101.8
101/07-18-039-27W3/00	647.1				0			0		0	745.0	-97.9
131/05-19-039-27W3/00	643.7				0			0		0	735.5	-91.8
141/09-19-039-27W3/00	671.3				0			0		0	777.0	-105.7
111/07-20-039-27W3/00	663.7				0			0		0	765.5	-101.8
141/13-20-039-27W3/00	671.1				0			0		0	774.2	-103.1
101/16-20-039-27W3/00	679.1				0			0		0	777.5	-98.4
111/02-21-039-27W3/00	671.8				0			0		0	764.0	-92.2
111/05-21-039-27W3/00	664.0				0			0		0	764.0	-100.0
111/07-21-039-27W3/00	679.3				0			0		0	768.0	-88.7
111/09-21-039-27W3/00	679.7				0			0		0	764.5	-84.8
101/10-21-039-27W3/00	679.7				0			0		0	766.5	-86.8
111/11-21-039-27W3/00	677.5				0			0		0	763.5	-86.0
111/15-21-039-27W3/00	677.9				0			0		0	763.5	-85.6
121/04-22-039-27W3/00	679.0				0			0		0	765.0	-86.0
111/06-22-039-27W3/00	677.0				0			0		0	761.5	-84.5
111/13-22-039-27W3/00	674.8				0			0		0	760.0	-85.2
111/02-23-039-27W3/00	689.6				0			0		0	783.5	-93.9
141/16-23-039-27W3/00	687.0				0			0		0	781.0	-94.0
111/02-24-039-27W3/00	695.7				0			0		0	791.4	-95.7
131/06-24-039-27W3/00	689.1				0			0		0	785.5	-96.4
111/08-24-039-27W3/00	687.9				0			0		0	780.0	-92.1
111/09-24-039-27W3/00	685.8				0			0		0	782.0	-96.2
101/10-24-039-27W3/00	687.6				0			0		0	786.0	-98.4
111/11-24-039-27W3/00	683.6				0			0		0	783.0	-99.4
131/11-24-039-27W3/00	684.5				0			0		0	785.0	-100.5
121/14-24-039-27W3/00	689.8				0			0		0	787.0	-97.2
131/15-24-039-27W3/00	694.7				0			0		0	691.0	3.7
111/16-24-039-27W3/00	689.6				0			0		0	784.7	-95.1
101/02-25-039-27W3/00	684.9				0			0		0	785.0	-100.1
101/10-25-039-27W3/00	690.8				0			0		0	786.0	-95.2
111/10-25-039-27W3/00	694.0				0			0		0	793.0	-99.0
121/11-25-039-27W3/00	698.6				0			0		0	791.0	-92.4
111/13-25-039-27W3/00	700.3				0			0		0	795.5	-95.2
141/14-25-039-27W3/00	696.5				0			0		0	792.5	-96.0
111/13-26-039-27W3/00	692.5				0			0		0	785.0	-92.5
141/16-26-039-27W3/00	709.9				0			0		0	808.5	-98.6
111/04-27-039-27W3/00	673.2				0			0		0	759.0	-85.8
111/05-27-039-27W3/00	667.4				0			0		0	758.0	-90.6
131/08-27-039-27W3/00	680.3				0			0		0	772.0	-91.7
101/14-27-039-27W3/00	683.4				0			0		0	782.5	-99.1
111/16-27-039-27W3/00	690.1				0			0		0	782.5	-92.4
101/01-28-039-27W3/00	673.8				0			0		0	761.0	-87.2
111/02-28-039-27W3/00	671.9				0			0		0	761.0	-89.1
111/03-28-039-27W3/00	674.8				0			0		0	769.5	-94.7
111/06-28-039-27W3/00	675.8				0			0		0	770.5	-94.7
111/11-28-039-27W3/00	669.3				0			0		0	769.0	-99.7
111/09-30-039-27W3/00	649.2				0			0		0	742.0	-92.8
111/06-31-039-27W3/00	662.5				0			0		0	750.5	-88.0
111/03-34-039-27W3/00	690.8				0			0		0	787.5	-96.7
111/09-34-039-27W3/00	697.1				0			0		0	792.5	-95.4
141/10-34-039-27W3/00	689.4				0			0		0	788.5	-99.1
101/05-35-039-27W3/00	705.3				0			0		0	799.5	-94.2
121/13-35-039-27W3/00	708.5				0			0		0	806.0	-97.5
101/01-36-039-27W3/00	679.1				0			0		0	776.0	-96.9
141/03-36-039-27W3/00	696.6				0			0		0	792.5	-95.9
111/04-36-039-27W3/00	703.7				0			0		0	797.5	-93.8
112/04-36-039-27W3/00	700.7				0			0		0	796.5	-95.8

Well I.D.	KB (m)	B. Valley TVD (m)	B. Valley SS (m)	F1Low. TVD (m)	F1Low. ISO (m)	Mid. Bkn TVD (m)	F1 Up. TVD (m)	F1 Up. ISO (m)	Miss. TVD (m)	Miss. ISO (m)	SubMesU. TVD (m)	SubMesU. SS (m)
111/06-36-039-27W3/00	695.9				0			0		0	794.0	-98.1
101/08-36-039-27W3/00	685.0				0			0		0	783.5	-98.5
111/13-36-039-27W3/00	703.9				0			0		0	801.0	-97.1
121/15-36-039-27W3/00	688.4				0			0		0	770.2	-81.8
101/03-27-025-28W3/00	746.8			1027.7		998.1	995.8	2.3	966.5	29.3	966.5	-219.7
121/07-36-025-28W3/00	669.5	997.3	-327.8	988.9	8.4	957.0	953.6	3.4	931.9	21.7	931.9	-262.4
141/07-08-027-28W3/00	685.8	959.9	-274.1	951.1	8.8	933.8	931.7	2.1	924.5	7.2	924.5	-238.7
121/16-23-027-28W3/00	661.0	919.7	-258.7	910.7	9	895.4		0		0	895.4	-234.4
111/10-27-027-28W3/00	647.4	891.0	-243.6	881.1	9.9	854.9	851.0	3.9	828.0	23	828.0	-180.6
111/15-36-027-28W3/00	685.9	933.9	-248	924.8	9.1	899.9	894.4	5.5	887.5	6.9	887.5	-201.6
111/10-01-029-28W3/00	697.9	910.7	-212.8	905.8	4.9	873.5	872.5	1	832.0	40.5	832.0	-134.1
101/11-18-029-28W3/00	721.9	905.9	-184	901.4	4.5	871.0	868.0	3	840.0	28	840.0	-118.1
111/09-34-029-28W3/00	685.6	861.4	-175.8	858.6	2.8	833.3	830.8	2.5	808.0	22.8	808.0	-122.4
101/16-35-029-28W3/00	694.3	906.4	-212.1	904.0	2.4	878.7	876.0	2.7	829.0	47	829.0	-134.7
131/06-03-030-28W3/00	690.0	878.5	-188.5	874.9	3.6	836.4	834.9	1.5	799.2	35.7	799.2	-109.2
101/05-10-030-28W3/00	683.6	852.5	-168.9	849.9	2.6	823.5	820.5	3	790.1	30.4	790.1	-106.5
101/08-12-030-28W3/00	694.3	886.8	-192.5	883.9	2.9	862.8	860.0	2.8	829.0	31	829.0	-134.7
111/07-24-030-28W3/00	691.4	888.4	-197	884.8	3.6	862.8	859.9	2.9	826.7	33.2	826.7	-135.3
161/13-03-031-28W3/00	703.5	895.8	-192.3	893.1	2.7	878.9	877.2	1.7	847.3	29.9	847.3	-143.8
121/01-11-031-28W3/00	734.6	904.0	-169.4	900.0	4	883.5	881.5	2	861.0	20.5	861.0	-126.4
101/07-16-031-28W3/00	704.1	881.0	-176.9	878.1	2.9	870.7	868.5	2.2	826.2	42.3	826.2	-122.1
131/16-21-031-28W3/00	690.0	853.8	-163.8	850.1	3.7	828.5	827.0	1.5	794.8	32.2	794.8	-104.8
101/12-22-031-28W3/00	683.9	849.0	-165.1	845.5	3.5	824.5	823.5	1	802.2	21.3	802.2	-118.3
101/14-25-031-28W3/00	689.2	839.7	-150.5	836.2	3.5	820.1	818.2	1.9	783.2	35	783.2	-94.0
131/02-27-031-28W3/00	666.2	836.2	-170	833.0	3.2	813.0	811.0	2	773.9	37.1	773.9	-107.7
101/02-28-031-28W3/00	681.5	856.4	-174.9	853.1	3.3	833.9	832.8	1.1	798.4	34.4	798.4	-116.9
101/15-29-031-28W3/00	731.5	878.9	-147.4	875.4	3.5	860.1	858.1	2	828.2	29.9	828.2	-96.7
101/10-32-031-28W3/00	725.7	895.5	-169.8	892.0	3.5	877.0	874.5	2.5	836.6	37.9	836.6	-110.9
111/04-02-032-28W3/00	665.3	804.5	-139.2	800.2	4.3	775.3		0	764.5	10.8	764.5	-99.2
140/09-02-032-28W3/00	667.8	814.6	-146.8	810.9	3.7	784.2		0	772.5	11.7	772.5	-104.7
121/12-02-032-28W3/00	676.9	810.6	-133.7	806.5	4.1	790.6	788.1	2.5	785.8	2.3	785.8	-108.9
111/13-02-032-28W3/00	684.2	817.7	-133.5	814.2	3.5	799.8	798.2	1.6	791.4	6.8	791.4	-107.2
131/01-03-032-28W3/00	671.0	803.5	-132.5	800.0	3.5	783.0	780.5	2.5	767.8	12.7	767.8	-96.8
121/12-07-032-28W3/00	736.6	890.2	-153.6	887.5	2.7	868.5	867.0	1.5	853.0	14	853.0	-116.4
131/11-21-032-28W3/00	717.6	859.8	-142.2	856.0	3.8	848.9	845.7	3.2	830.2	15.5	830.2	-112.6
101/13-21-032-28W3/00	731.2	866.5	-135.3	862.6	3.9	856.9	853.7	3.2	842.8	10.9	842.8	-111.6
131/07-28-032-28W3/00	734.8	888.2	-153.4	883.6	4.6	871.0	869.7	1.3	846.5	23.2	846.5	-111.7
101/10-28-032-28W3/00	734.9	894.5	-159.6	891.6	2.9	874.7		0	847.9	26.8	847.9	-113.0
111/08-29-032-28W3/00	731.6	874.3	-142.7	870.5	3.8			0	844.8	25.7	844.8	-113.2
111/01-30-032-28W3/00	724.0	874.2	-150.2	870.5	3.7			0	845.6	24.9	845.6	-121.6
101/07-36-032-28W3/00	707.7			898.7	2.1	884.9	883.0	1.9	845.4	37.6	845.4	-137.7
191/09-36-032-28W3/00	700.0								851.9		851.9	-151.9
121/05-02-033-28W3/00	726.9	878.8	-151.9	874.5	4.3	866.0		0		0	866.0	-139.1
101/06-03-033-28W3/00	733.7	875.2	-141.5	871.6	3.6	864.7		0		0	864.7	-131.0
111/10-04-033-28W3/00	726.4	872.0	-145.6	869.6	2.4	857.1		0		0	857.1	-130.7
101/06-05-033-28W3/00	739.7	898.1	-158.4	894.9	3.2	892.0		0	883.3	8.7	883.3	-143.6
101/06-07-033-28W3/00	734.3	897.6	-163.3		0			0		0	897.6	-163.3
101/07-08-033-28W3/00	741.0	887.5	-146.5		0			0		0	887.5	-146.5
121/06-09-033-28W3/00	730.4	885.0	-154.6	879.0	6			0		0	879.0	-148.6
111/06-11-033-28W3/00	727.3	889.5	-162.2	885.5	4			0		0	885.5	-158.2
131/06-13-033-28W3/00	738.1					895.5	893.9	1.6		0	893.9	-155.8
101/16-13-033-28W3/00	727.9			875.5		872.1		0		0	872.1	-144.2
111/09-14-033-28W3/00	735.5	875.1	-139.6		0			0		0	875.1	-139.6
101/13-18-033-28W3/00	713.2	865.6	-152.4		0			0		0	865.6	-152.4
101/06-19-033-28W3/00	713.2	865.6	-152.4		0			0		0	865.6	-152.4
101/16-23-033-28W3/00	737.9	885.5	-147.6	879.3	6.2	877.3	875.0	2.3		0	875.0	-137.1
101/08-26-033-28W3/00	741.9				0			0		0	866.5	-124.6
111/11-26-033-28W3/00	737.3	873.5	-136.2	870.3	3.2	862.8		0		0	862.8	-125.5
101/10-27-033-28W3/00	748.3	900.8	-152.5	893.8	7	884.2		0		0	884.2	-135.9
131/05-29-033-28W3/00	726.9	874.9	-148	871.1	3.8	863.5		0		0	863.5	-136.6
111/16-32-033-28W3/00	760.8	904.5	-143.7	901.7	2.8	884.6		0		0	884.6	-123.8
101/05-33-033-28W3/00	746.8	899.4	-152.6	895.5	3.9	883.2		0		0	883.2	-136.4
111/07-34-033-28W3/00	750.4	881.8	-131.4	878.4	3.4			0		0	878.4	-128.0
111/08-35-033-28W3/00	729.3	868.9	-139.6	865.6	3.3	861.8	858.4	3.4	849.4	9	849.4	-120.1
121/07-36-033-28W3/00	723.9	867.9	-144	865.1	2.8	858.3	856.0	2.3		0	856.0	-132.1
191/07-36-033-28W3/00	727.3	859.6	-132.3	856.1	3.5	850.5	846.2	4.3	836.7	9.5	836.7	-109.4
101/15-36-033-28W3/00	732.8	882.4	-149.6	879.2	3.2	866.7	863.5	3.2	849.7	13.8	849.7	-116.9
130/10-01-034-28W3/00	714.8	866.6	-151.8	863.2	3.4	848.8		0		0	848.8	-134.0
131/06-02-034-28W3/00	739.1	891.4	-152.3	888.5	2.9	866.4		0		0	866.4	-127.3
111/01-08-034-28W3/00	766.7	909.5	-142.8	905.5	4	893.5	892.0	1.5		0	892.0	-125.3
111/10-14-034-28W3/00	756.1	892.1	-136	890.4	1.7	878.8	877.2	1.6	863.7	13.5	863.7	-107.6
141/14-22-034-28W3/00	783.6	914.2	-130.6	911.1	3.1	895.1	893.9	1.2		0	893.9	-110.3
141/06-27-034-28W3/00	778.1	900.1	-122	897.5	2.6	884.3		0		0	884.3	-106.2
131/07-32-034-28W3/00	741.6	847.0	-105.4		0			0		0	847.0	-105.4
141/06-34-034-28W3/00	788.8	905.4	-116.6		0			0		0	905.4	-116.6
131/06-04-035-28W3/00	724.6	858.4	-133.8	855.1	3.3	844.5		0	839.6	4.9	839.6	-115.0
141/04-05-035-28W3/00	705.3	831.6	-126.3	826.1	5.5			0		0	826.1	-120.8
141/08-05-035-28W3/00	726.9	860.7	-133.8	857.4	3.3	845.5		0	840.3	5.2	840.3	-113.4

Well I.D.	KB (m)	B. Valley TVD (m)	B. Valley SS (m)	F1Low. TVD (m)	F1Low. ISO (m)	Mid. Bkn TVD (m)	F1 Up. TVD (m)	F1 Up. ISO (m)	Miss. TVD (m)	Miss. ISO (m)	SubMesU. TVD (m)	SubMesU. SS (m)
131/08-06-035-28W3/00	698.3	826.8	-128.5	823.6	3.2	815.0	813.6	1.4		0	813.6	-115.3
111/13-12-035-28W3/00	772.6	884.2	-111.6	881.5	2.7	873.1		0		0	873.1	-100.5
101/02-16-035-28W3/00	708.7	834.6	-125.9	833.1	1.5	822.5	822.5	0		0	822.5	-113.8
101/04-16-035-28W3/00	698.0	826.1	-128.1	823.8	2.3	813.8		0		0	813.8	-115.8
111/07-17-035-28W3/00	701.6	851.0	-149.4	845.5	5.5	836.6		0	799.4	37.2	799.4	-97.8
121/02-20-035-28W3/00	738.8	861.5	-122.7	859.0	2.5	841.5		0		0	841.5	-102.7
121/15-21-035-28W3/00	803.2			910.6	3.2	905.9		0		0	905.9	-102.7
101/15-25-035-28W3/00	777.2	877.6	-100.4	874.4	3.2	861.5	858.9	2.6		0	858.9	-81.7
101/03-26-035-28W3/00	748.3	854.6	-106.3	851.8	2.8	845.9		0		0	845.9	-97.6
101/04-26-035-28W3/00	758.6	865.3	-106.7	862.1	3.2	854.3		0		0	854.3	-95.7
131/12-26-035-28W3/00	744.3	852.8	-108.5	849.0	3.8	841.0	839.2	1.8		0	839.2	-94.9
111/16-26-035-28W3/00	758.2	868.7	-110.5	862.0	6.7	848.6	846.7	1.9		0	846.7	-88.5
102/16-27-035-28W3/00	744.0	857.1	-113.1	853.1	4	840.0		0		0	840.0	-96.0
111/08-28-035-28W3/00	795.2	905.7	-110.5	903.2	2.5	890.9		0		0	890.9	-95.7
101/13-28-035-28W3/00	789.1	900.5	-111.4	896.0	4.5	886.0		0		0	886.0	-96.9
111/11-31-035-28W3/00	753.7	890.1	-136.4	887.1	3	881.8	881.8	0		0	881.8	-128.1
121/03-33-035-28W3/00	789.3	895.4	-106.1	890.8	4.6	885.4		0		0	885.4	-96.1
111/07-34-035-28W3/00	722.9	831.8	-108.9	829.1	2.7	817.2		0		0	817.2	-94.3
191/10-34-035-28W3/00	721.8	906.6	-184.8	902.8	3.8	893.1		0		0	893.1	-171.3
111/11-34-035-28W3/00	729.1	834.4	-105.3	831.4	3	821.5		0		0	821.5	-92.4
101/01-35-035-28W3/00	744.0	856.7	-112.7	853.8	2.9	840.4		0		0	840.4	-96.4
101/02-35-035-28W3/00	726.0	849.1	-123.1	845.8	3.3	825.4		0		0	825.4	-99.4
101/03-35-035-28W3/00	725.7	838.5	-112.8	835.1	3.4	822.5		0		0	822.5	-96.8
101/04-35-035-28W3/00	725.4	837.7	-112.3	834.1	3.6	822.3		0		0	822.3	-96.9
101/06-35-035-28W3/00	722.1	831.9	-109.8	829.1	2.8	820.1		0		0	820.1	-98.0
101/08-35-035-28W3/00	727.3	843.9	-116.6	839.9	4	829.2		0		0	829.2	-101.9
111/08-36-035-28W3/00	757.6	862.0	-104.4	859.2	2.8	849.0		0		0	849.0	-91.4
131/10-09-036-28W3/00	726.9			846.6	4	833.9		0		0	833.9	-107.0
121/07-10-036-28W3/00	712.2				0			0		0	817.2	-105.0
161/13-11-036-28W3/00	720.9				0			0		0	818.7	-97.8
101/10-15-036-28W3/00	725.1			854.6	1.7	844.9	844.9	0	813.4	31.5	813.4	-88.3
131/01-16-036-28W3/00	725.1				0			0	835.0	10	835.0	-109.9
121/07-16-036-28W3/00	725.9				0			0	850.1	11.9	850.1	-124.2
101/10-16-036-28W3/00	728.2				0			0		0	833.6	-105.4
141/04-17-036-28W3/00	729.6				0			0		0	863.4	-133.8
131/10-17-036-28W3/00	728.9				0			0		0	865.0	-136.1
101/07-18-036-28W3/00	729.4				0			0		0	861.1	-131.7
131/13-18-036-28W3/00	730.2				0			0		0	860.0	-129.8
121/14-18-036-28W3/00	730.0				0			0		0	861.3	-131.3
111/08-19-036-28W3/00	728.5				0			0		0	860.2	-131.7
111/06-21-036-28W3/00	735.6				0			0		0	855.0	-119.4
101/10-21-036-28W3/00	731.5				0			0		0	849.2	-117.7
111/12-27-036-28W3/00	693.4				0			0		0	799.6	-106.2
111/02-28-036-28W3/00	717.7				0			0		0	841.1	-123.4
111/07-29-036-28W3/00	721.7				0			0		0	840.1	-118.4
121/07-30-036-28W3/00	742.2				0			0		0	875.2	-133.0
141/10-31-036-28W3/00	708.0				0			0		0	829.0	-121.0
111/16-31-036-28W3/00	687.0				0			0		0	807.2	-120.2
111/10-32-036-28W3/00	677.5				0			0		0	797.5	-120.0
111/10-33-036-28W3/00	668.6				0			0		0	785.8	-117.2
121/16-01-037-28W3/00	724.5				0			0		0	821.3	-96.8
191/07-03-037-28W3/00	666.0				0			0		0	759.5	-93.5
101/08-04-037-28W3/00	666.3				0			0		0	781.1	-114.8
111/12-04-037-28W3/00	665.2				0			0		0	782.0	-116.8
111/14-04-037-28W3/00	664.4				0			0		0	779.2	-114.8
101/07-05-037-28W3/00	667.8				0			0		0	796.3	-128.5
101/08-06-037-28W3/00	675.1				0			0		0	796.0	-120.9
111/10-06-037-28W3/00	677.2				0			0		0	796.0	-118.8
101/13-06-037-28W3/00	677.9				0			0		0	796.7	-118.8
111/16-06-037-28W3/00	673.8				0			0		0	801.0	-127.2
191/04-07-037-28W3/00	676.1				0			0		0	792.5	-116.4
101/07-07-037-28W3/00	693.4				0			0		0	810.0	-116.6
101/12-07-037-28W3/00	683.1				0			0		0	803.6	-120.5
101/14-07-037-28W3/00	688.8				0			0		0	804.3	-115.5
101/01-08-037-28W3/00	679.7				0			0		0	793.9	-114.2
111/10-08-037-28W3/00	664.2				0			0		0	789.0	-124.8
191/14-12-037-28W3/00	720.0				0			0		0	798.2	-78.2
141/10-14-037-28W3/00	726.0				0			0		0	811.8	-85.8
101/04-17-037-28W3/00	680.9				0			0		0	795.5	-114.6
101/07-17-037-28W3/00	665.4				0			0		0	780.6	-115.2
101/11-17-037-28W3/00	679.4				0			0		0	786.0	-106.6
101/13-17-037-28W3/00	673.9				0			0		0	787.3	-113.4
101/02-18-037-28W3/00	667.8				0			0		0	786.0	-118.2
131/03-18-037-28W3/00	670.3				0			0		0	786.6	-116.3
101/04-18-037-28W3/00	676.7				0			0		0	796.8	-120.1
101/08-18-037-28W3/00	681.8				0			0		0	800.0	-118.2
101/09-18-037-28W3/00	680.3				0			0		0	793.1	-112.8
141/15-18-037-28W3/00	662.3				0			0		0	779.3	-117.0

Well I.D.	KB (m)	B. Valley TVD (m)	B. Valley SS (m)	F1Low. TVD (m)	F1Low. ISO (m)	Mid. Bkn TVD (m)	F1 Up. TVD (m)	F1 Up. ISO (m)	Miss. TVD (m)	Miss. ISO (m)	SubMesU. TVD (m)	SubMesU. SS (m)
101/02-19-037-28W3/00	671.2				0			0		0	783.0	-111.8
101/03-19-037-28W3/00	671.8				0			0		0	786.7	-114.9
101/07-19-037-28W3/00	668.7				0			0		0	780.2	-111.5
121/11-21-037-28W3/00	680.1				0			0		0	803.9	-123.8
101/06-23-037-28W3/00	741.9				0			0		0	846.0	-104.1
101/07-24-037-28W3/00	748.6				0			0		0	829.0	-80.4
111/07-30-037-28W3/00	664.7				0			0		0	779.1	-114.4
111/15-31-037-28W3/00	671.2				0			0		0	784.1	-112.9
101/07-33-037-28W3/00	683.1				0			0		0	798.0	-114.9
141/06-36-037-28W3/00	738.1				0			0		0	823.5	-85.4
111/15-02-038-28W3/00	695.0				0			0		0	788.3	-93.3
141/11-06-038-28W3/00	660.0				0			0		0	771.9	-111.9
131/10-07-038-28W3/00	655.8				0			0		0	766.2	-110.4
111/06-08-038-28W3/00	671.5				0			0		0	788.0	-116.5
131/11-09-038-28W3/00	674.8				0			0		0	798.5	-123.7
111/01-10-038-28W3/00	694.5				0			0		0	800.4	-105.9
111/01-11-038-28W3/00	698.5				0			0		0	773.7	-75.2
131/11-12-038-28W3/00	708.7				0			0		0	776.3	-67.6
131/15-13-038-28W3/00	701.7				0			0		0	791.4	-89.7
141/09-14-038-28W3/00	702.6				0			0		0	792.7	-90.1
141/15-14-038-28W3/00	696.1				0			0		0	788.3	-92.2
121/14-16-038-28W3/00	666.3				0			0		0	789.6	-123.3
101/10-17-038-28W3/00	652.6				0			0		0	780.1	-127.5
111/03-18-038-28W3/00	672.4				0			0		0	782.6	-110.2
111/05-19-038-28W3/00	672.0				0			0		0	797.6	-125.6
121/06-22-038-28W3/00	678.2				0			0		0	780.8	-102.6
131/11-22-038-28W3/00	676.8				0			0		0	777.2	-100.4
131/09-23-038-28W3/00	684.6				0			0		0	770.2	-85.6
111/03-24-038-28W3/00	691.4				0			0		0	778.7	-87.3
101/05-24-038-28W3/00	692.2				0			0		0	782.1	-89.9
141/06-24-038-28W3/00	684.9				0			0		0	763.8	-78.9
111/06-25-038-28W3/00	680.5				0			0		0	753.4	-72.9
121/07-25-038-28W3/00	679.9				0			0		0	749.0	-69.1
111/01-27-038-28W3/00	678.3				0			0		0	775.1	-96.8
111/16-27-038-28W3/00	670.0				0			0		0	773.1	-103.1
111/01-29-038-28W3/00	658.8				0			0		0	788.0	-129.2
101/04-36-038-28W3/00	683.4				0			0		0	787.7	-104.3
111/11-01-039-28W3/00	673.6				0			0		0	755.5	-81.9
111/15-01-039-28W3/00	643.0				0			0		0	716.0	-73.0
141/10-02-039-28W3/00	644.8				0			0		0	742.0	-97.2
111/06-04-039-28W3/00	678.5				0			0		0	780.0	-101.5
141/01-11-039-28W3/00	677.9				0			0		0	771.5	-93.6
142/01-11-039-28W3/00	677.5				0			0		0	770.9	-93.4
101/07-11-039-28W3/00	693.7				0			0		0	789.5	-95.8
121/03-12-039-28W3/00	647.7				0			0		0	730.0	-82.3
111/11-12-039-28W3/00	691.9				0			0		0	769.5	-77.6
101/09-14-039-28W3/00	672.1				0			0		0	764.0	-91.9
101/05-15-039-28W3/00	686.4				0			0		0	786.5	-100.1
101/10-22-039-28W3/00	676.4				0			0		0	777.0	-100.6
101/06-23-039-28W3/00	672.8				0			0		0	763.0	-90.2
101/14-23-039-28W3/00	673.3				0			0		0	768.0	-94.7
141/15-23-039-28W3/00	671.9				0			0		0	764.9	-93.0
101/10-24-039-28W3/00	659.6				0			0		0	770.5	-110.9
111/04-26-039-28W3/00	670.7				0			0		0	763.0	-92.3
101/06-26-039-28W3/00	663.2				0			0		0	756.0	-92.8
131/08-28-039-28W3/00	682.5				0			0		0	778.5	-96.0
141/13-29-039-28W3/00	697.8				0			0		0	799.5	-101.7
101/10-33-039-28W3/00	683.7				0			0		0	773.5	-89.8
101/04-34-039-28W3/00	676.4				0			0		0	771.0	-94.6
111/11-34-039-28W3/00	658.7				0			0		0	754.5	-95.8
111/13-34-039-28W3/00	657.1				0			0		0	751.5	-94.4
141/15-34-039-28W3/00	652.3				0			0		0	750.0	-97.7
121/16-34-039-28W3/00	653.7				0			0		0	750.0	-96.3
111/03-35-039-28W3/00	659.9				0			0		0	757.0	-97.1
101/05-35-039-28W3/00	656.5				0			0		0	762.0	-105.5
131/06-35-039-28W3/00	655.0				0			0		0	758.5	-103.5
131/12-35-039-28W3/00	652.8				0			0		0	749.5	-96.7
111/06-36-039-28W3/00	680.0				0			0		0	797.0	-117.0
121/07-36-039-28W3/00	678.2				0			0		0	759.0	-80.8
101/07-09-025-29W3/00	747.4			1054.5		1026.5	1021.2	5.3	1006.8	14.4	1006.8	-259.4
111/07-25-025-29W3/00	780.6	1085.9	-305.3	1080.1	5.8	1053.4	1048.2	5.2	1035.4	12.8	1035.4	-254.8
141/04-01-027-29W3/00	738.3	1005.8	-267.5	996.9	8.9	962.1	960.6	1.5	935.5	25.1	935.5	-197.2
101/16-22-027-29W3/00	700.1	939.6	-239.5	930.9	8.7	902.3	896.1	6.2	885.9	10.2	885.9	-185.8
101/06-36-027-29W3/00	711.5	953.7	-242.2	945.4	8.3	922.6	918.6	4	906.4	12.2	906.4	-194.9
101/10-01-028-29W3/00	694.0	929.1	-235.1	921.1	8	902.3	896.4	5.9	827.5	68.9	827.5	-133.5
101/07-02-029-29W3/00	712.9			921.1		888.3	887.0	1.3	840.0	47	840.0	-127.1
101/10-15-029-29W3/00	728.8	906.9	-178.1	903.6	3.3	868.6	867.2	1.4	834.5	32.7	834.5	-105.7
101/10-35-029-29W3/00	702.9	877.9	-175	874.9	3	850.4	845.5	4.9	822.4	23.1	822.4	-119.5

Well I.D.	KB (m)	B. Valley TVD (m)	B. Valley SS (m)	F1Low. TVD (m)	F1Low. ISO (m)	Mid. Bkn TVD (m)	F1 Up. TVD (m)	F1 Up. ISO (m)	Miss. TVD (m)	Miss. ISO (m)	SubMesU. TVD (m)	SubMesU. SS (m)
111/14-34-030-29W3/00	723.9	896.5	-172.6	894.6	1.9	877.7	873.8	3.9	839.8	34	839.8	-115.9
121/16-01-031-29W3/00	704.6	881.5	-176.9	878.4	3.1	864.4	862.0	2.4	830.2	31.8	830.2	-125.6
121/09-02-031-29W3/00	707.0	901.5	-194.5	899.7	1.8	876.5	874.9	1.6	840.5	34.4	840.5	-133.5
131/01-11-031-29W3/00	717.5	899.6	-182.1	896.4	3.2	876.5	875.0	1.5	847.6	27.4	847.6	-130.1
131/07-12-031-29W3/00	699.5	879.8	-180.3	875.6	4.2	859.0	856.0	3	828.5	27.5	828.5	-129.0
111/08-13-031-29W3/00	693.4	866.4	-173	862.0	4.4	849.9	849.0	0.9	820.0	29	820.0	-126.6
121/06-36-031-29W3/00	708.8	857.4	-148.6	854.8	2.6	828.6		0	807.2	21.4	807.2	-98.4
111/06-12-032-29W3/00	735.5	901.2	-165.7	898.4	2.8	887.5	884.0	3.5	820.0	64	820.0	-84.5
101/10-36-032-29W3/00	715.7	874.0	-158.3	870.2	3.8	865.6	861.7	3.9	838.2	23.5	838.2	-122.5
111/08-11-033-29W3/00	712.6	859.2	-146.6	854.9	4.3	838.8	836.4	2.4	822.0	14.4	822.0	-109.4
111/07-24-033-29W3/00	720.9	865.5	-144.6	864.1	1.4			0		0	864.1	-143.2
121/12-24-033-29W3/00	710.7				0			0		0	851.8	-141.1
101/07-36-033-29W3/00	736.1				0			0		0	898.0	-161.9
111/10-13-034-29W3/00	731.5	875.6	-144.1	870.1	5.5	855.7	854.1	1.6	850.1	4	850.1	-118.6
101/10-24-034-29W3/00	733.6	878.5	-144.9	875.0	3.5	871.8	869.2	2.6		0	869.2	-135.6
141/08-12-037-29W3/00	675.4				0			0		0	796.0	-120.6
141/08-13-037-29W3/00	665.1				0			0		0	785.7	-120.6
141/09-13-037-29W3/00	664.8				0			0		0	784.8	-120.0
111/01-24-037-29W3/00	673.0				0			0		0	790.2	-117.2
111/08-24-037-29W3/00	687.6				0			0		0	806.0	-118.4
111/16-36-038-29W3/00	669.6				0			0		0	786.0	-116.4